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THE NATIVE PERSIMMON.

By W. F. FLETCHER,
Scientific Assistant, Office of Horticultural and Pomological Investigations.

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INTRODUCTION.

The persimmon seems to have been the first native American fruit to be described and praised by the early explorers. De Soto learned its food value in 1539, and in 1557 published an account of it at Evora, Portugal. The following year, 1558, Jan de Laet described the persimmon in his work on Virginia. John Smith's narrative of the settlements and resources of the New World, written during the first years of the seventeenth century, included a long discussion of the persimmon. In his reference to this fruit, where he says "If it be not ripe, it will draw a man's mouth awrie with much torment," he so well characterizes the puckering, astringent effect of the tannin contained in the immature fruit that no other comment is necessary.

The persimmon tree has received more criticism, both adverse and favorable, than almost any other known species. Those who have discussed the food value of the fruit, from the earliest chroniclers to recent writers, have prophesied that the tree would soon be accorded a place in our gardens and orchards. Those people, on the other hand, who have been acquainted only with the immature fruit or with the young sprouts in cultivated fields have had nothing to say

NOTE.—This is a general bulletin, intended for those to whom knowledge of the production, preparation, and uses of the native persimmon is of value.

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in its favor and have bent their energies toward its destruction rather than its propagation and cultivation.

There are several factors which are responsible for the slow progress of persimmon development in this country. One reason for the neglect of this fruit seems to be the erroneous yet oft-repeated statement that persimmons are unfit to eat until they have either been touched by frost or frozen. Although this statement has been corrected by nearly every one who has studied the subject, nevertheless throughout the regions where persimmons are grown many of the best fruits are lost each year because they ripen and fall before frost or before they are supposed to be edible. The truth of the matter is that freezing is as detrimental to the quality of persimmons as to the quality of any other fruit. If persimmons are not edible and free from astringency before frost, it is because the variety is a late one and the fruit has not yet matured.

The development of the persimmon, whether for orchard or ornamental purposes, has been retarded by the difficulty encountered in propagating and transplanting it. One grower has characterized it as the only tree that he could not kill in his cultivated fields and the only one that he could not make live in his garden. Failure in transplanting is usually due to a lack of knowledge concerning the characteristic root development of the persimmon. Under natural conditions, the roots penetrate much deeper into the soil than those of most other fruit trees, and unless great care is exercised when the tree is taken up it is almost impossible to get more than a small percentage of the root system, thus reducing the chance of making the tree live when transplanted.

From time to time valuable trees have been discovered, cared for, and even in some cases transplanted or propagated. Most of these have been soon neglected or destroyed, until there are comparatively few varieties of marked value available for general distribution.

Both De Soto and Jan de Laet when describing the ripe fruit of the native persimmon call it a "delicious little plum," and John Smith and other writers of the seventeenth century speak of it as a plum with the flavor of an apricot. This use of the word "plum" doubtless directed the attention of many people to the native species of Prunus, which include our wild cherries and plums.

BOTANICAL CLASSIFICATION.

The persimmon belongs to the ebony family (Ebenaceæ) and is known to botanists as *Diospyros virginiana*. It is the only member of the family which is indigenous to any extensive portion of this country.

NATURAL DISTRIBUTION OF THE PERSIMMON.

Roughly speaking, the persimmon is indigenous to the southeastern quarter of the United States, being found in large numbers

in the fields and forests of that section. The more favored localities in Iowa and eastern Nebraska produce many fruits, but very few trees are found west of central Kansas. Scattering specimens in Connecticut and on Long Island mark the present northeastern limit of the species. A few trees in Rhode Island, New York, and Michigan which produce fairly well indicate that the northern limit of cultivation may be extended whenever economic conditions (that is, the value of the fruit for food or of the tree for ornamental purposes) seem to warrant.

The zone of greatest productivity and adaptability, wherein appear by far the largest number of promising types, extends from Maryland, Virginia, and the Carolinas westward through Missouri and Arkansas. The persimmon thrives equally well on the sands of the Coastal Plain, the shales of the Allegheny Mountains, the muck of the river-bottom lands, and the chert of the Ozarks.

FIG. 1.—An old persimmon tree which shows the characteristic checking of the bark.

GENERAL DESCRIPTION OF THE PERSIMMON.

HABIT OF GROWTH.

Throughout the habitat of the persimmon there is a wide variation in the size and growth of the trees and in the form, size, color, and number of seeds of the fruit. The tree characters seem to indicate two types, upright and drooping, and these tree types are closely allied with the fruit types.

When grown in the open, persimmon trees rarely reach a height of 50 feet. In a dense forest growth they sometimes reach 70 or 100 feet, but that is uncommon. The characteristic checking of the bark of an old tree, which is shown in figure 1, aids one to recognize the species. The top of the tree is usually roundish or conical in form. Large trees are often somewhat irregular, owing to the breaking of limbs by heavy crops of fruit; moreover, it is a characteristic of productive trees to prune themselves by dropping many of the fruit-bearing twigs. The branches are always spreading, often

coming out almost at right angles to the trunk and then drooping more or less, especially after the tree has borne a few crops.

The leaves are elliptical or slightly ovate in form, acuminate at the apex, measuring from 3 to 6 inches in length and 1 to 3 inches in width, with a short petiole. In color, they are a dark glossy green on the upper surface and a grayish green underneath. Trees differ markedly, however, in habits of growth, as is shown in figures 2, 3, and 4.

FLOWERING HABIT.

The flowers resemble little four-lipped urns of wax, from one-fourth to three-fourths of an inch in length, the color varying from a greenish yellow to a milky white. They are borne on short stalks and appear from the last of April in the extreme South until the middle of June at the northern limit of the persimmon habitat.

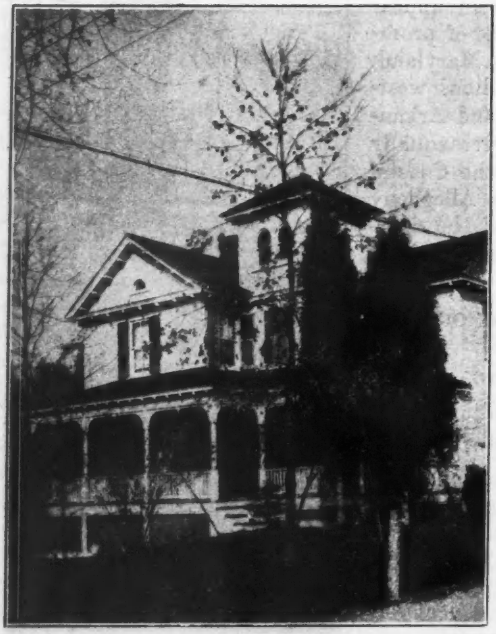

FIG. 2.—A persimmon tree of the upright type which produces large, oblate fruits and is here used as a dooryard tree.

The trees are generally dicœcious; that is, the pollen-bearing and fruit-producing flowers are borne on separate trees. The pistillate or fruit-producing flowers are borne singly, while the staminate or pollen-bearing flowers are generally produced in threes. The pollen is very light and powdery, and while it is generally distributed by the bees that frequent the trees in great numbers during blossoming time it can also be carried to great distances by the wind.

FRUIT CHARACTERS.

The fruit is a true berry, containing sometimes as many as eight seeds in its pale, translucent flesh. It varies in form from oblate to oblong and in diameter from three-fourths of an inch to 2 inches.

There is a wide range in color, varying from yellow to pale orange and even to a dark red, with many varietal markings, often blushed and covered with a bluish bloom. When green, persimmons are generally very astringent and puckery, because of the large quantity of tannin contained in the flesh, but when thoroughly mature and ripe the flavor is rich and sweet, and the consistency varies between that of a baked apple and a soft custard. The fruits of many late varieties turn a rich dark red and partially dry on the trees, somewhat resembling dates in appearance and flavor.

FIG. 3.—A persimmon tree of upright habit of growth which produces fruit of the pyriform type, ripening in midseason.

POSSIBILITIES OF IMPROVEMENT.

The season of the native persimmon is probably longer than that of any other wild fruit, both locally and over the country as a whole. In many sections the earliest and the latest varieties may be found growing side by side, or at least within a few miles of each other. The Bureau of Plant Industry has records for both early and late varieties from the southern part of Georgia and Florida. In the District of Columbia there are some trees which ripen their fruit in August and others on which it hangs until February.

Generally speaking, the best fruits are neither the earliest nor the latest, but rather those that ripen just before the beginning of the tree's dormant season. The latest varieties are still immature when the leaves fall or when they are killed by frost, and they must complete the ripening process within themselves instead of drawing nourishment from the tree until they have grown to maturity.

The largest as well as the best fruits are those that ripen about the time the trees shed their leaves. The early varieties are nearly all medium in size, and the late varieties which hang on until cold weather

are generally small. Seedless fruits, as a rule, are smaller and earlier than those with seeds produced on the same trees.

The wide variations shown by the fruit in size, color, season of maturity, and tendency to seedlessness, and by the trees in size, shape, and vegetative vigor indicate the possibility of greatly improving the native persimmon. Up to the present time one essential factor has been overlooked in all attempts at breeding better varieties. That factor is the parentage of the male or pollen-bearing trees. Without a knowledge of the characters represented in the male parent there is no certainty as to the results of the crossing and no possibility of the line breeding which is essential to the rapid development of improved varieties. Definite efforts should be made in breeding work to secure pollen-bearing trees of known parentage. They should be selected from among trees grown from seed produced on the most desirable fruit-bearing trees.

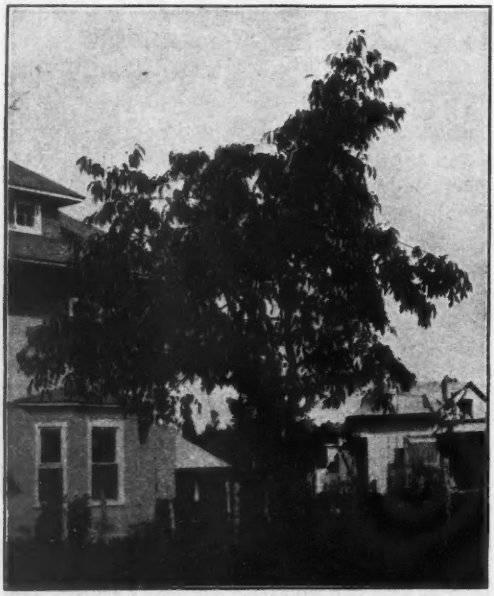

FIG. 4.—A persimmon tree which has a drooping habit of growth and produces fruit of the oblong type.

PRESENT STATUS OF THE NATIVE PERSIMMON.

Throughout the region where persimmons are found in abundance the fruit is considered as being "good for dogs, hogs, and 'possums." Occasionally a family is mentioned as having lived for several months upon the fruit from a single large tree. Twenty or thirty nurserymen are selling seedling trees for ornamental planting and half a dozen others have selected named varieties of special merit which they offer for the production of fruit.

In some of the large cities and towns within the persimmon habitat, the wild fruit can be purchased during the autumn and early winter from the dealers who occupy the open stalls in the public markets. A few enterprising growers adjacent to large cities have built up a demand which they find themselves unable to supply.

The methods of utilizing the persimmon are at present rather limited. Fresh fruit is used in various ways—in making a few forms of bread or pone, in preparing certain homemade beverages and sweetmeats, and as forage for the hogs and dogs which get most of their living from the woods.

The object of this publication is to set forth the best methods of propagating and cultivating persimmon trees, to call attention to the many trees worthy of propagation, to indicate the food value of the fruit, and to enumerate various ways in which persimmons may be prepared.

PROPAGATION OF THE PERSIMMON.

As is the case with most tree fruits, the persimmon does not reproduce its varietal characteristics through the seed, and other methods of propagation are, therefore, necessary to perpetuate desirable varieties. Propagation of the persimmon by the methods commonly employed with tree fruits is more difficult than for such fruits as the apple or the peach. The methods described below have been found successful in actual practice.

SEEDAGE.

The seeds of the persimmon are scattered by mammals and birds and in the natural sequence of events reach the ground in the fall or winter without becoming dry. They are lightly covered with grass or leaves and are subjected to the varying temperatures of winter, always remaining moist. The following spring the seeds sprout as soon as the soil becomes warm enough, provided that the conditions accompanying the rise in temperature do not dry them unduly. Seeds which fall under the trees are usually too much exposed to the atmosphere and dry too much to admit of germination.

Seeds that are gathered for propagating purposes should be stratified at once. If they are allowed to dry out it is often necessary to soak them for two or three days before they are planted, the water being renewed each day at a boiling temperature.

The seed bed in which persimmon seedlings are grown should be located on well-drained land where the soil is rather light and well supplied with humus. The ground should be plowed deep with a subsoil plow unless the subsoil is friable enough to permit the ready penetration of the long taproots which characterize the growth of persimmon seedlings.

The seed may be planted either in the fall or spring, after being treated as described above. It is commonly planted in shallow drills and lightly covered with soil to a depth of one-half inch or a little more.

CUTTAGE.

ROOT CUTTINGS.

The roots of persimmon trees sprout readily when the top is removed or when the main stem meets with serious injury. This is illustrated in figure 5, which shows the development of sprouts on the roots of a seedling tree two months after the removal of the top. During this period the seedling had been in a propagating bed in a greenhouse, under artificial heat. This illustration also offers an explanation for the occurrence of the large clumps of similar trees that are to be found in many abandoned fields. At some time the original tree was cut off near the surface of the ground and the roots sent up sprouts which, being undisturbed, developed into trees bearing similar fruit.

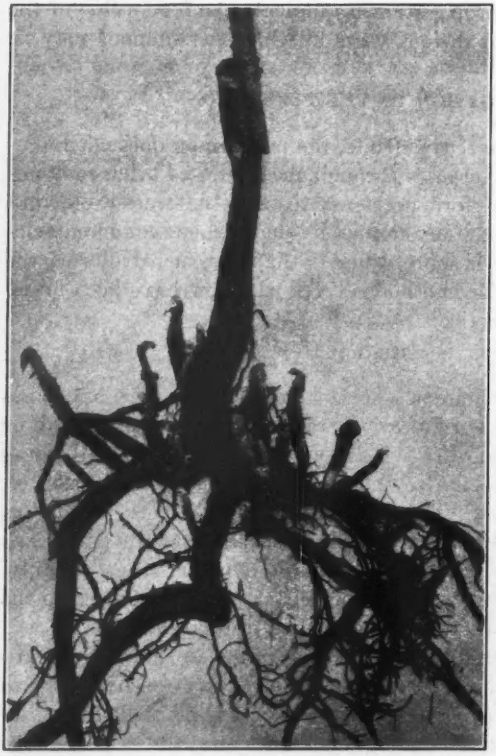

FIG. 5.—A 2-year-old seedling persimmon tree which has been grafted. It has been in a propagating bed in a greenhouse under artificial heat for two months. The sprouts on the roots show how easily the roots may be used as a means of propagating the variety.

Roots the size of a lead pencil or larger can be used in propagating the persimmon. They should be cut into pieces 6 or 8 inches long, the ends sealed with grafting wax, hot beeswax, or pitch, in order to prevent the decay that develops rapidly in the soft, spongy wood, and the cuttings should then be buried over winter in sand or in a nursery row. They will grow readily the following spring, provided the moisture supply is plentiful until they become well established.

WOOD CUTTINGS.

Cuttings of the branches may be treated in much the same way as root cuttings. Small twigs are unsuitable for purposes of propaga-

tion (1) because they lack sufficient substance to produce the callus and root formation and (2) because it is extremely difficult to prevent the organisms of decay from entering the soft, porous, 1-year-old wood. The cuttings should be waxed or pitched at both ends and buried until well callused and the roots have started. They may then be planted in a nursery row and vegetative growth encouraged.

Wood 2 or 3 years old may be selected for cuttings, but care must be exercised to procure good, strong buds. The cuttings may be taken at any time after the trees become dormant in the fall and may be placed in cold storage or in sand until wanted. It is most important, however, that the ends of the cuttings should be dipped immediately into melted wax in order to exclude the air. If they have been exposed for even a few hours they should be retrimmed and waxed before being put in cold storage or sand.

GRAFTAGE.

Those who have trees bearing exceptionally fine persimmons will find the different methods of grafting admirally adapted to top-working the worthless trees about the place with the better varieties, thus changing them to useful fruitfulness.

Top-worked, or grafted, portions of old trees will bear two or three years earlier than trees which come from buds or grafts on 1 or 2 year old stocks. These seedling stocks, budded or grafted with a selected variety, will bear one or two years earlier than those produced from cuttings.

The scions to be used in chip budding, cleft grafting, and whip grafting should be cut during late winter. All scions should be kept cool and moist until used. The budding and grafting should be done as soon as the trees which are to be grafted start to grow.

Because of the similarity in the operations of budding and grafting they are here treated together under the general heading of graftage. The various methods which have been found to be best adapted to the persimmon are here discussed.

SELECTION OF SCIONS AND BUD STICKS.

When selecting scions or bud sticks care must be exercised, just as when propagating by wood cuttings, to procure wood with strong, well-developed buds. On twigs of the last season's growth the best buds are generally near the base, where they are supported on more mature wood than those near the tip. In wood more than a year old, most of the buds near the tip have already produced branches, thus making this portion of the twig unsuitable for use in budding or grafting.

The method employed in budding persimmons largely determines the character of the wood that should be selected as a source of buds.

For the common shield or T bud, the basal half of the new growth is preferable because the bark is thinner than that on older wood and the buds fit closer and better than where wood with older and thicker bark is used. Moreover, the buds near the base of the new wood are better than those toward the tip, because the latter are so irregular in outline that it is difficult to fit them closely to the stock.

When the chip-bud method is used it is essential that the bud stick have sufficient body to allow the removal of the bud with a clean, solid chip adhering thereto. A bud stick should never be larger than the stock on which the buds are to be worked. If it is too large in relation to the size of the stock which is to receive the bud, the chip will be so broad and flat that it can not be properly fitted into any notch which it is possible to make in the stock.

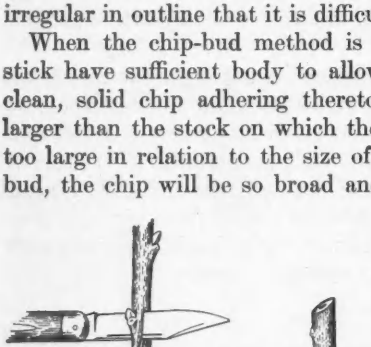

FIG. 6.—The different steps in shield or T budding: *a*, Cutting the bud; *b*, preparing the stock; *c*, inserting the bud; *d*, tying.

For annular or patch budding, the most satisfactory buds are those taken from wood that is 2, 3, or even 4 years old. Such buds are but lightly attached to the wood and have a good body of bark, which makes them easy to handle and not liable to dry out. Buds taken from near the base of large, vigorous, new shoots will also give good results.

The various methods of budding and grafting that have proved satisfactory in propagating the persimmon have been described in detail in publications of the Department of Agriculture relating to other fruits and to nuts. For convenience in the present connection, extracts from these publications are inserted below.

SHIELD OR "T" BUDDING.[1]

The height at which buds are inserted [where small seedling stocks are used] varies with the operator. In general, the nearer the ground the better. The cut for the reception of the bud is made in the shape of a letter T. (Fig. 6, *b*.) Usually the crosscut is not quite at right angles with the body of the tree, and the stem to the T starts at the crosscut and extends toward the root for an inch or more. The flaps of bark caused by the intersection of the two cuts are slightly loosened with the ivory heel of the budding knife, and the bud, grasped by the leaf stem as a handle, is placed under the flaps and firmly pushed in place until its cut surface is entirely in contact with the peeled body of the stock. (Fig. 6, *c*.) A ligature is then tightly drawn about, above, and below the bud, to hold it in place until a union shall be formed.

[1] Corbett, L. C. The propagation of plants. Farmers' Bulletin 157, pp. 22-23.

(Fig. 6, *d*.) Bands of raffia about 8 or 10 inches long make a most convenient tying material. As soon as the buds have united with the stock the ligature should be cut, in order to prevent girdling the stock. This done, the operation is complete until the following spring, when all the trees in which the buds have "taken" should have the top cut off just above the bud.

Shield budding may be done at any time when the trees are in vigorous growth and when well-matured buds of the current season's growth can be obtained. This period usually extends from July to September. When budding seedlings it may sometimes be necessary to delay the operation until the latter part of the season, in order that the stock may develop to a satisfactory size; but when top-working older trees by this method well-developed buds may be handled whenever the trees are in a vigorous condition of growth. Figure 7 shows a branch of a young persimmon tree on which a shield or T bud has made considerable growth.

FIG. 7.—A shield or T bud after considerable growth has been made.

Some of the precautions which it has been found important to observe when propagating pecans are equally applicable in the propagation of persimmons. The following directions for budding pecans according to the various methods are therefore presented here.[1]

ANNULAR BUDDING.

The process [of annular budding] is also known as "ring" and "flute" budding. It is performed during the midsummer months at such time as the bark is found to slip (release) most readily. In some seasons this period may be very brief, lasting only a few days, while in other years the time during which annular budding may be successfully performed extends over a period of several months. In the latitude of southern Georgia it is not uncommon for this method to be successful from as early as May 10 until late in July or even in August.

Annular budding consists merely in transferring a ring of bark to which is attached a bud of the desired variety from a bud stick[2] to the trunk or branch of another tree in place of a similar ring of bark previously removed. Specially designed tools have been devised for the purpose of cutting the rings. Two ordinary propagating knives having single blades may be fastened together and made to answer the purpose, although they are less liable to make uniform incisions. Cut a ring of bark from the stock with one of the tools, slit it with a single-bladed knife, and lift from its bed or "matrix," as it is technically called. Discard this bark and from the bud stick

[1] Reed, C. A. The pecan. Bureau of Plant Industry Bulletin 251, pp. 25-31.

[2] The bud stick is a branch cut from a tree of the variety to be propagated.

remove a similar ring, in the center of which is a dormant bud. The bark of the bud stick should be slit on the side opposite the bud. Immediately place this ring in the space left by removing the bark from the stock and wrap at once with waxed cloth, taking care not to cover the bud (fig. 8).

PATCH BUDDING.

When the annular method is used it is obvious that the stock and scion must be of nearly the same size. If the bud stick is slightly larger than the stock a portion of the bark to which the bud is attached may be cut away so that the two ends of the ring just meet around the stock. If the bud stick should be smaller than the stock, a strip of bark on the latter may be left in position to complete the ring. In actual practice, rings which extend only partly around the stock are most commonly used. Such process, however, is not true annular budding, because any bark which extends only partly around the stock is merely a patch. It is to this deviation from the annular method of budding that the term "patch budding" has been applied. A tool specially designed for patch budding consists of four thin steel blades fastened together in the form of a rectangle, five-eighths of an inch wide by 1 inch long, and is used as a punch.

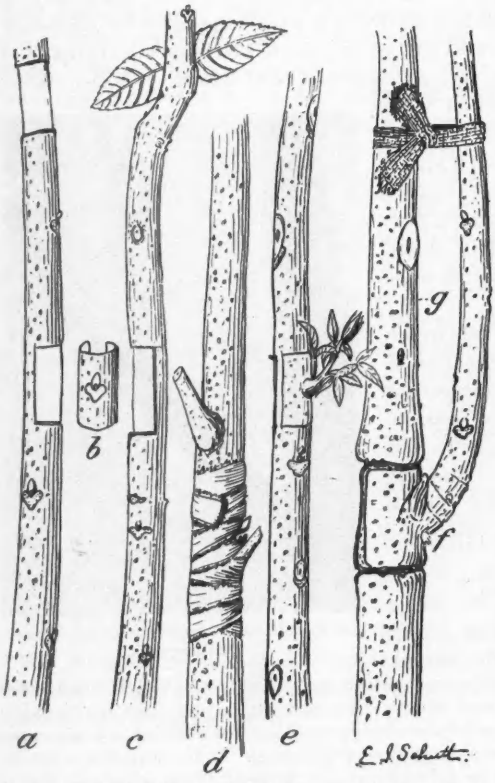

FIG. 8.—Annular budding. *a*, Bud stick from which the bud has been removed; *b*, the bud ready for insertion in the matrix of the stock; *c*, the stock ready to receive the bud; *d*, the bud after being placed in position and carefully wrapped; *e*, growth taking place, the wrapping having been removed; *f*, growth from the bud supported by being tied to the stock (*g*) above the union. Note the scars above the union, where the buds were removed in order to direct the flow of sap to the new bud.

A cut is made in the bark of the bud stick about half an inch in width by three times as long, in the center of which is the bud. The piece of bark so outlined is removed from the bud stick and laid over that of the stock. Using this as a pattern, incisions are then made around it in the bark of the stock. The pattern is then removed, the section of bark outlined in the stock is lifted, and the bark from the bud stick is put in its place. Some varieties of the pecan are more difficult to bud successfully than others; with such varieties the annular method, or a near approach to it, is generally most successful.

With the average sorts, however, the tendency among the more experienced nurserymen is much inclined to favor the patch method.

The buds best suited to annular or patch budding are those in the axils of the leaves at the base of the current season's growth. It is well worth the time required to clip the leaves away, close to the buds, 10 days or 2 weeks before the bud is wanted, for by so doing the wound will heal over before the bud is needed; otherwise a serious lessening of the vigor of the bud through evaporation may take place.

CARE OF ANNULAR AND PATCH BUDS.

In annular budding the added ring of bark sometimes unites with the stock promptly, permitting the upward flow of sap to proceed without much interference. When this is the case the top should be carefully pruned back to such a degree as is necessary to direct sufficient sap into the new bud to cause it to swell. This pruning should not be done with too great severity, as an oversupply of sap is liable to accumulate under the bark of the new bud and cause it to decay, or, as it is termed, "to drown" the bud. If the tree is young and the growth has been rapid, precaution should be exercised in cutting back the top, in order not to expose the tender bark to the heat of the sun. A sufficient amount of foliage should be left as a protection from the hot sun. If the supply of sap be limited, it will be well to cut out all buds in the top of the stock, as shown in figure 8. All dormant buds, both above and below the new bud, should be rubbed off as soon as they begin to swell. The wrapping about the new bud must be cut as soon as growth begins. As the union of a bud with a stock made by any method of budding is at first merely the uniting together of bark and not of wood, it is necessarily weak during the first few months. To avoid danger of breaking out at the bud, the new tops should be provided with extra support. For this purpose side stakes driven into the ground are sometimes used, but these are expensive and unnecessary. By leaving a stub of the original top 8 or 10 inches long, entirely denuded of foliage (fig. 8), the new top may be quickly tied to it, and when no longer needed the dead stub may be cut away close to the union.

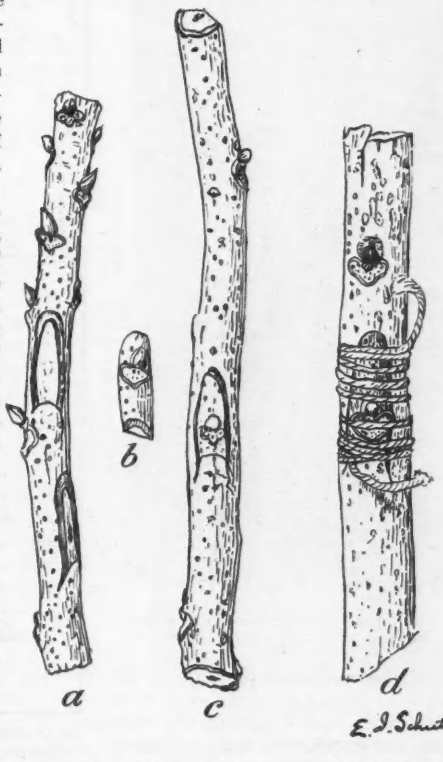

FIG. 9.—Chip or "dormant" budding. *a*, The bud stick; *b*, the bud ready for insertion; *c*, the bud inserted in the matrix of the stock; *d*, the bud securely tied in place.

CHIP BUDDING.

Propagation by chip budding is performed in the early spring or late in the dormant period. Because of being done at this season it is also known as "dormant" budding.

With a sharp knife a downward cut is made below the bud on the bud stick to a depth of perhaps one-eighth of an inch. Raising the knife to a point above the bud, a long downward cut is made, which meets the lower end of the first cut, and the bud is removed with a chip attached, as shown in figure 9. A similar chip is removed from the stock, and the desired bud is put in its place. This should be carefully wrapped with such material as will hold the cambium layers of the stock and the bud firmly together on at least one side.

Subsequent treatment similar to that already described for annular and patch budding should be given young trees propagated in this summer.

Trees of the pecan species are difficult to propagate asexually; that is, neither buds nor scions "take" with the readiness of ordinary fruit trees. The inexperienced

FIG. 10.—A chip bud on a branch after the bud inserted had made considerable growth.

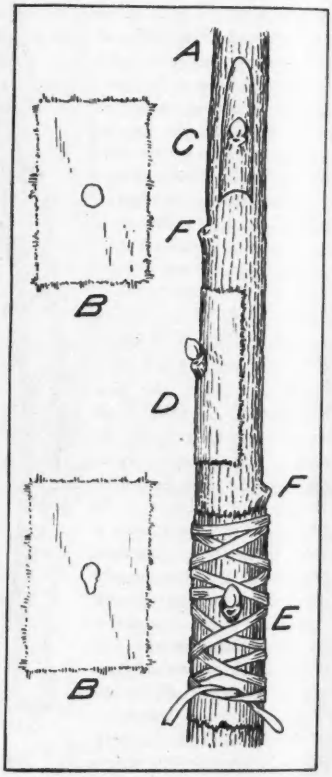

FIG. 11.—Method of using a bud protector on a chip bud. The protector may be used in a similar manner in all of the different forms of budding. *A*, stock; *B*, *B*, waxed cloth protectors; *C*, chip bud fitted into notch in stock; *D*, protector in position over the bud; *E*, protector and bud wrapped and tied; *F*, *F*, scars of buds removed from stock. (Adapted from drawing in American Fruit and Nut Journal, vol. 6, whole no. 94, p. 23.)

operator, therefore, must expect a very low percentage of living buds as the result of his first attempts. Skilled propagators, however, are now so successful that under favorable conditions the percentage of failures is no longer a matter of consequence.

No attempt to bud pecans should be made on rainy days, or in early mornings following heavy dews. Some nurserymen even go so far as to select their men for budding the pecan, assigning those who perspire most freely to other duties. Extremely hot days should be avoided, especially if accompanied by drying winds. Moderately cool, cloudy days without wind or rain are the best for pecan budding.

Figure 10 shows a persimmon chip bud which has made considerable growth.

PROTECTION OF BUDS.

A very satisfactory means of affording protection to buds inserted by any of the foregoing methods is shown in figure 11. These waxed shields are intended as a substitute for the waxed strips previously mentioned, and their preparation and use has been described as follows:[1]

In making the waxed wrappers, old domestic from worn bed sheets or undergarments may be used. Tear it into strips 2 feet long and 6 inches wide; then fold it into squares and dip it into a tin plate of hot, melted beeswax. The wax will strike through instantly, and then the strips may be held up by one end and the surplus wax allowed to drip back into the tin plate. When cool, the cloth may be torn into * * * squares of proper size. No pressing or squeezing is necessary. The beeswax answers the purpose in every way; its saves the buds, and that is the end in view. These

FIG. 12.—Cleft graft: *a*, Stock being split by special grafting tool; *b*, scion ready for insertion; *c*, scion in place ready for waxing.

wrappers may be left on the buds the whole season. When the bud shoots are an inch or so in length, the strings may be unwound from so much of the wrappers as cover the buds; but tie the upper end of the wrapper, which is above the bud, firmly to the projecting stub. The eyelets[2] in the wrappers will open as the bud shoots grow, and protection will be afforded against hot suns and chilly nights.

CLEFT GRAFTING.[3]

FIG. 13.—A cleft graft made on a small branch.

This style of graft is particularly adapted to large trees when for any reason it becomes necessary to change the variety. Branches too large to be worked by other methods can be cleft-grafted.

A branch 1 or 1½ inches in diameter is severed with a saw. Care should be taken that the bark be not loosened from any portion of the stub. Split the exposed end with a broad, thin chisel or grafting tool (fig. 12, *a*). Then with a wedge or the wedge-shaped prong at the end of the grafting tool spread the cleft so that the scions (fig. 12, *b*) may be inserted (fig. 12, *c*).

[1] American Fruit and Nut Journal, v. 6, no. 94, p. 22.

[2] The eyelet referred to is the small hole in the center of the protector shown in figure 11.

[3] Corbett, L. C. The propagation of plants. Farmer's Bulletin 157, pp. 17-18.

The scion should consist of a portion of the previous season's growth and should be long enough to have two or three buds. The lower end of the scion, which is to be inserted in the cleft, should be cut into the shape of a wedge, having the outer edge thicker than the other. In general, it is a good plan to cut the scion so that the lowest bud will come just at the top of this wedge, so that it will be near the top of the stock. The importance of having an intimate connection between the growing tissues of both scion and stock can not be too strongly emphasized, for upon this alone the success of grafting depends. To make this contact of the growing portions doubly certain, the scion is often set at a slight angle with the stock into which it is inserted, in order to cause the growing portions of the two to cross.

Fig. 14.—A cleft graft made at the crown, the soil which normally covered the union having been removed in order to show the parts to better advantage.

After the scions have been set the operation of cleft grafting is completed by covering all cut surfaces with a layer of grafting wax.

Cleft grafting has given satisfactory results with the persimmon, both on the branches (fig. 13) and at the crown (fig. 14).

WHIP GRAFTING.[1]

Whip grafting is the style almost universally used in root grafting. It has the advantage of being well adapted to small plants.

The graft is made by cutting the stock off diagonally—one long smooth cut with a sharp knife, as shown in figure 15, *a*. Place the knife about one-third of the distance from the end of the cut surface, at right angles to the cut, and split the stock in the direction of its long axis. Cut the lower end of the scion in like manner (fig. 15, *b*), and when the two parts are forced together, as shown in figure 15, *c*, the cut surfaces will fit neatly together, and one will nearly cover the other if the scion and stock are of

[1] Corbett, L. C. The propagation of plants. Farmers' Bulletin 157, pp. 18–19.

the same size. A difference in diameter of the two parts to be united may be disregarded unless it be too great. After the scion and stock have been locked together, as shown in figure 15, *c*, they should be wrapped with five or six turns of waxed cotton to hold the parts firmly together.

While top grafting may be done in this way (fig. 16), it is in root grafting that the whip graft finds its distinctive field. When the roots are cut into lengths of 2 to 5 or 6 inches to be used as stocks, the operation is known as piece-root grafting. Sometimes the entire root is used.

In ordinary propagation by means of whip grafts, the scion is cut with about three buds, and the stock is nearly as long as the scion. The graft is so planted as to bring the union of stock and scion not very far below the surface of the ground.

CARE OF WHIP GRAFTS.[1]

When grafted by the whip-graft method the young trees will require little subsequent attention other than pruning and ordinary cultivation. When the root is that of a very young tree there will be no danger of the supply of plant food being such as to induce a growth of top that is too rapid, as is frequently the case with cleft grafts, especially in the tops of old trees. While temporary staking as a support to the union is not necessary, in numerous cases stakes will be highly essential to insure erect growth. The moisture of the ground causes the wrapping material to decay in the course of a few weeks, and it is therefore not necessary to cut the bands.

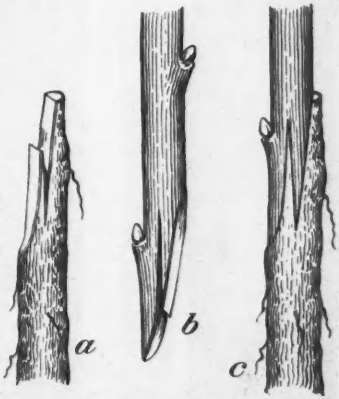

FIG. 15.—Whip graft: *a*, Stock prepared; *b*, scion prepared; *c*, stock and scion fitted together ready for tying.

The operation of grafting most fruits is generally successful if performed in the spring when the trees are still dormant, or even after growth has started slightly, provided the scions are entirely dormant. In the case of the persimmon, however, much more satisfactory results appear to be obtained when the grafting is delayed until the trees have definitely started into new growth. The scions must be kept dormant.

In all of the various methods of budding and grafting the persimmon it is of the utmost importance that the cut surfaces of both bark and wood be protected with as little delay as possible from chemical change due to exposure to the air. Protection is afforded by covering the wounds with grafting wax, waxed cloth, or similar devices.

STOCKS AND NURSERY TREES.

The stocks in the nursery row should stand at least 6 inches apart, to afford space for root development and to give the workmen plenty of room when the trees are budded or grafted. The young trees

[1] Reed, C. A. The pecan. Bureau of Plant Industry Bulletin 251, p. 25.

in the nursery should receive fair cultivation, and the roots should be pruned each year with a tree digger or spade in order to keep the root system small enough to be handled with ease when the trees are dug. The 2-year-old roots are always preferable for stocks. Older roots which are small enough to be easily handled are likely to be

FIG. 16.—A whip graft after attaining considerable growth.

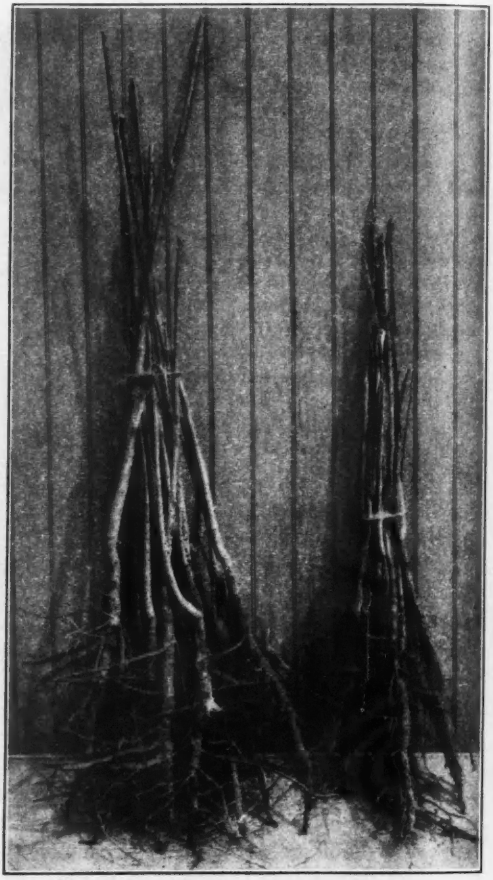

FIG. 17.—Persimmon trees after making one season's growth in the nursery. These trees were propagated by grafting on seedling stocks. The bundle on the left is the Golden Gem variety; on the right, the Miller. The largest trees are 4 to 5 feet tall. The difference in the size of the trees in the two bundles is due to the difference in the natural vigor of growth of these two sorts.

stunted, and 1-year-old roots must be very thrifty to produce the desired growth in the graft.

Trees which have been produced under conditions favorable for development may be planted in their permanent location after they have made one season's growth in the nursery. Some varieties, however, are much more vigorous than others. It may be advisable to grow the weaker sorts in the nursery for two years

before transplanting them. Figure 17 shows two varieties of grafted persimmon trees that have made one season's growth in the nursery.

On account of the very long taproot which persimmon trees habitually develop, particularly when propagated on seedling stocks, much care must be exercised to avoid undue injury to the root systems when the trees are dug from the nursery. Moreover, because of the deep-rooting habits of these trees a deep soil should be selected for their permanent location.

CULTIVATION OF THE PERSIMMON.

PLANTING.

The transplanting of the young trees may be done at any time during the dormant period, from late autumn to early spring, when the roots can be protected from freezing temperatures and evaporation and when the soil is in a suitable condition for handling. If the trees have been properly taken up without undue injury to the roots, the tops will need little or no pruning. If, on the other hand, the root systems have been severely reduced, the tops should be headed back until the total length of branches and trunks corresponds in a general way to the total length of the main roots. Wounds on both tops and roots should be waxed as soon as made.

Young persimmon trees have large, deep root systems and should be planted 2 or 3 inches deeper in the orchard than they were in the nursery row. In setting them out the soil should be packed thoroughly around the roots. A round-pointed wooden tamp is a very serviceable tool with which to make the earth compact as the hole is filled up. The planting plan varies with the type of tree desired. If it seems desirable to grow low-headed trees with the expectation of producing large fruit that can be readily picked by hand, the permanent trees should be placed at least 16 or, better still, 20 feet apart each way. If, however, a large bulk of fruit is desired as stock feed to be scraped from the ground or picked up by animals, a fair degree of success may be expected if the trees are planted 10 feet apart each way.

TILLAGE.

Probably the persimmon can be more successfully intercropped than any other fruit tree, owing to the depth of its root system. Blackberries, dewberries, strawberries, and vegetables thrive very well among persimmons until the shade becomes too dense. When the trees shade the ground, it is best to seed down the orchard if it is to be used as a run for chickens, calves, pigs, or other animals and the fruit used as stock feed. If it is planned to produce fruit for market purposes, however, the same cultivation should be given the ground as in a commercial orchard of peach or other fruit trees.

PRUNING.

The pruning of the persimmon varies with the variety. There is a tendency for the tree to prune itself, as many of the fruit-bearing twigs die and drop off with their fruit, thus making the natural open growth of the trees still more open and reducing to a minimum the necessity for pruning. There are two points, however, which should be borne in mind: (1) The upright tendency of some of the most vigorous varieties should be checked by pinching off the tender growing tips as they get out of reach, and (2) those trees that do not prune themselves sufficiently to keep the top well open should be thinned by removing entire limbs either main or secondary. This practice is preferable to opening the tops by thinning out the small branches and thus leaving the larger limbs bare for a considerable portion of their length. Thinning admits light and air, and at the same time a stronger vegetative growth is induced; the result is that the size of the fruit is kept uniform and the crops are made more regular by reducing the tendency to overbear on alternate years.

All wounds should be painted or otherwise covered as soon as made, in order to prevent the wood from drying or dying back and decay from entering the body of the trees.

DISEASES AND INSECT PESTS.

The persimmon is exceptionally free from the attacks of diseases and insect pests. Probably the most important of the insect enemies of the persimmon is the hickory twig girdler. The following brief account of the life history and habits of this insect, prepared for this bulletin by the Bureau of Entomology, may be of interest to those who anticipate growing the persimmon:

The hickory twig girdler, *Oncideres cingulata* Say, makes its appearance about the middle of August and may be found until the first of October. It begins depositing its eggs about the latter part of August and continues the process well into October. The eggs hatch in from seven to nine days after deposition, and the young larva begins to feed on the inner bark and wood at the point where the egg was inserted beneath the bark. As the larva increases in size it continues to feed on the wood, going deeper into the twig, and by the time its full growth has been attained it often completely hollows out the twig for some little distance from the point where it began work. Some of the larvæ attain their full growth and begin transformation to pupæ about the first of August. Others do not make this change until near the middle of September. The pupal stage lasts from 10 to 14 days, when the insects transform to adults and emerge from the twigs where they have spent their lives. Several days pass before they begin laying their eggs in the small limbs and twigs.

The injury caused by this insect occurs in the process of oviposition. The adult gnaws a small hole in the bark, usually just above or just below a bud, and the egg is inserted beneath the bark by means of the ovipositor. Several eggs are usually deposited in a twig in this manner, and the insect then begins girdling the twig beneath the point of oviposition by gnawing out small pieces of the bark. A ring is thus made around the twig, perhaps a third of the way through, weakening it to such an extent that it is broken off by the wind during the winter or the following spring. The trees are often severely injured by having the young growth pruned off in this manner.

In order to control this insect the twigs should be picked up from the ground in June or early July. All twigs which are found at this time have been girdled and broken from the tree and should be collected and burned in order to destroy the insects which are inside them.

USES OF THE PERSIMMON TREE.

The largest purchases of persimmon wood are made by the manufacturers of cotton-mill supplies, who use the timber in making bobbins. The wood is well suited for this work, as it is strong, comparatively light, hard, elastic, and close grained, taking a high polish. Shoe lasts are also made to some extent from persimmon wood.

The tree has some value for shade and ornamental purposes. Concerning this use of the native persimmon Mr. F. L. Mulford, landscape gardener of the Department of Agriculture, writes as follows:

As an ornamental for lawns the persimmon compares favorably with any of the shade trees used on private grounds, provided that it does not overhang a sidewalk, where the dropping of fruits would be objectionable. The broad, glossy leaves on the gracefully drooping branches give a dense shade from early in the spring until the autumn is well advanced.

In the early summer the little waxlike flowers fill the air with a delicious fragrance, somewhat resembling that of the calla lily. When the fruit begins to mature, yellowish and golden clusters appear among the dark-green leaves and add to the beauty of the tree until they fall. Some of the later varieties are ornamental after the leaves have fallen and even until well into the winter.

USES OF THE PERSIMMON FRUIT.

The only fruit which equals the persimmon in food value is the date. This is shown by the analyses presented in Table I.

TABLE I.—*Comparative analyses of fresh fruits, showing their food values in percentages of the weight of the fruit.*[1]

Fruit.	Total solids.	Ash.	Protein.	Sugars.	Crude fiber.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Apples	13.65	0.28	0.69	10.26	0.96
Blackberries	13.59	.48	.51	4.44	5.21
Cherries	22.30	.65	.81	11.72	.62
Currants	15.23	.72	.51	6.38	4.57
Dates	[2][3] 66.86	[4] 1.20	[5] 1.48	[6] 56.59	[7] 3.80
Figs	20.13	.57	1.34	15.51	.....
Grapes[8]	[2] 21.83	.53	.59	[9] 17.11	3.60
Oranges (Navel)	13.87	.43	.48	15.91	.....
Peaches[7]	[2] 10.60	.40	.70	[6] 5.90	3.60
Pears	16.97	.31	.36	8.23	4.30
Persimmons[10]	[2] 35.17	.78	.88	[9] 31.74	1.43
Plums	15.14	.61	.40	3.56	4.34
Raspberries	13.79	.49	.53	3.95	5.90
Strawberries	9.48	.60	.97	5.36	1.51

[1] Data, with exceptions as noted, from Bureau of Chemistry Bulletin 66, pp. 41–42.
[2] Dry matter.
[3] Average of 11 analyses. See "Chemistry and ripening of the date," Arizona Agricultural Experiment Station Bulletin 66, p. 408.
[4] See "Principles of nutrition and nutritive value of food," Farmers' Bulletin 142, p. 18.
[5] Adapted from the two publications mentioned in footnotes 3 and 4.
[6] Fats and carbohydrates.
[7] See "Use of fruit as food," Farmers' Bulletin 293, p. 14.
[8] See "The American persimmon," Indiana Experiment Station Bulletin 60 (1896), p. 52.
[9] Nitrogen-free extract.
[10] Average of 6 analyses in "The American persimmon," Indiana Experiment Station Bulletin 60 (1896).

Probably the most common use of the fruit is as feed for hogs. As a rule, the hogs are merely turned loose in lots where persimmon trees have come up naturally. Some, however, who appreciate the value of this fruit as stock feed have set out orchards in order to provide a definite supply for this purpose. If varieties are selected which ripen in a continuous sequence, the fruit will, in some sections, furnish forage for hogs from the last of August until early winter. A small area devoted to persimmons can thus be made a valuable asset for any general farm located in a persimmon district which includes hogs among its stock.

The persimmon fruits intended for shipment should, to avoid bruising, be carefully hand picked while still quite firm, that is, just as the flesh begins to soften. Fruits which can be delivered direct to the consumer should not be picked until fully mature and should also be handled with great care. Fruit of the later varieties, especially those of the oblong type, often hang on the trees for weeks, drying to about the consistency of the commercial date.

Quart and pint size berry boxes are commonly used when packing the fruit for market, the baskets being handled in the ordinary strawberry crates. Larger units would result in bruising the softer fruits and are therefore not advisable. Crates in which the individual fruits are placed in separate compartments are suggested for shipping the better grades of persimmons, and it is believed that a trade which will fully repay the expense and trouble of this method of handling can be built up in any town of moderate size. Persimmons which are placed in storage should be packed in egg crates or similar containers that hold the fruits separate.

RECIPES FOR USING PERSIMMONS.

Before the advent of the white man, the Indians mixed the pulp of this fruit with crushed corn and made it into a kind of bread. Now, there are many ways in which the fruit can be used, but the different methods are not well known, and many people with fine trees in their possession are allowing the fruit to waste because they do not realize its value. The dissemination of knowledge regarding the use of the persimmon in preparing very palatable food products should result in much wider use of the fruit. To this end a number of recipes are included in this publication.

Since heat makes the astringency of the persimmon more apparent, it is always well to add one-half teaspoonful of baking soda (bicarbonate of soda) to each cupful of persimmon pulp in all recipes where the fruit is subjected to heat. Although it has been proved by experiment that the soda may be omitted if the fruit is entirely free from astringency, it is better to use it until one is sure of the quality of the persimmon pulp.

PERSIMMON BREAD.

1 cup of persimmon pulp.
1 cup of water.
½ teaspoonful of soda.
Yeast.
Shortening.
Flour to make a stiff dough.

Set to rise, mold, and bake like other bread.

PERSIMMON CRUMPETS.

Take 1 pint of the sponge of persimmon bread which has been set over night, add one egg and enough milk to make a thin batter, set to rise for one hour, then bake on a hot griddle like griddlecakes. Serve hot with butter or sirup.

PERSIMMON GRIDDLECAKES.

1 cup of persimmon pulp.
1 egg.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.
Milk to make a thin batter.

Bake and serve as above.

PERSIMMON-PEANUT GRIDDLECAKES.

1 cup of persimmon pulp.
1 tablespoonful of peanut butter.
1 egg.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.
Milk to make a thin batter.

Bake and serve as above.

PERSIMMON-PEANUT MUFFINS (A GOOD RECIPE FOR CAMPERS).

½ cup of persimmon pulp.
1 tablespoonful of peanut butter.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.

Press or cut in pats ½ inch thick and bake in a quick oven.

COFFEE FRUIT CAKE.

Boil together 1 cup of molasses and 1½ cups of minced dried persimmons for five minutes. Cream 1 cup of sugar, ½ cup of butter and 1 egg, and add to the above. Stir in three-fourths of a cup of strong coffee and place on a warm stove. Add 2 cups of flour; 1½ teaspoonfuls of mixed ground spice; 1½ teaspoonfuls of a phosphate baking powder, or if preferred, 1 teaspoonful of baking powder and ½ teaspoonful of soda.

Bake in a moderate or slow oven 40 minutes to 1 hour.

PERSIMMON CAKE.

1 cup of persimmon pulp.
½ cup of sugar.
1 egg.
Butter of size of a walnut.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.

Bake 40 minutes in a moderate oven. For a soft pudding leave out the eggs. For a custard leave out the flour and the baking powder.

PERSIMMON PUDDING (CAKE OR PONE).[1]

1 pint of fine persimmon pulp.
1 cup of sugar.
1 quart of sweet milk.
3 cups of flour.
1 teaspoonful of ground cinnamon.
2 teaspoonfuls of baking powder.

[1] The American persimmon. Indiana Experiment Station Bulletin 60, pp. 43-54, 1896.

PRESERVED PERSIMMON PULP.

Place equal amounts of persimmon pulp and sugar in glass or earthenware jars or in coated sanitary cans. (Never use cans of uncoated tin for persimmons.) Mix thoroughly and set in a cool, light place. Stir occasionally until the air is removed and seal with paraffin or waxed paper. The cans may be heated over a slow fire, just enough to drive out the air, and should be sealed at once.

PRESERVED WHOLE PERSIMMONS.

Put a thin layer of sugar in the bottom of a jar; then a layer of whole ripe persimmons, then a layer of sugar; and so on until the jar is full. The sugar will soon dissolve and form a sirup. Press the upper fruits down under the sirup or add more sirup to the jars. Seal and store until used. The sirup may be drained off and the fruits served like dates, which they will resemble very much in both appearance and flavor.

PERSIMMON LEATHER.

Spread a thin layer of ripe persimmon pulp on waxed paper or on a large platter. Dry in the sun, in a fruit evaporator, or in the oven of a stove, leaving the oven doors open. Remove the seeds. Add another layer of pulp, and repeat until the leather is of a thickness to handle easily. This may be diced or minced and used instead of raisins or citron in fruit cakes, cookies, or puddings.

PERSIMMON ICE CREAM.

2 cups of persimmon pulp. 1 cup of thick, sweet cream.

Beat together thoroughly and freeze like ordinary ice cream. The fruit must be thoroughly ripe and nonastringent.

PERSIMMON FRUIT ICE.

2 cups of persimmon pulp. 1 cup of sugar.

Beat to a creamy pulp and freeze.

PERSIMMON TAFFY.

Two cups of the sirup from the preserved whole persimmons. Add 1 cup of sugar and cook until it forms a hard ball in water. Pour on a buttered platter and pull. Cut in sticks and squares.

PERSIMMON FUDGE.

2 cups of persimmon pulp. 2 cups of sugar.

Cook over a slow fire, stirring occasionally, until graining begins. Add 1 teaspoonful of baking soda and stir over the fire until quite stiff. Spread on buttered platter or paraffin paper.

SELECTED AND CULTIVATED NAMED VARIETIES.

The native persimmon varieties that have thus far received names and been disseminated for cultivation have originated as chance seedlings, being brought into cultivation from the wild state. With few exceptions, the fruits of these varieties are of the oblate type. Brief descriptions of the fruit of some of the better known varieties follow.

DESCRIPTIONS OF VARIETIES.

Burrier. Origin, central Kentucky, where it ripens rather early; form, oblate; size, medium; color, yellow; practically seedless; flesh, soft; quality, very good.

Boone (*Daniel Boone*). Origin, Indiana, where it ripens during October and November; form, roundish oblate; size, medium; color, yellow, with a dull blush in the sun; skin, rather tough; seeds, numerous; flavor, sweet but not rich; quality, good.

Delmas. Origin, Scranton, Miss., where it ripens during October and early November; form, roundish oblate; size, medium to large; color, reddish yellow; skin, thin and tough; seeds, numerous; flavor, sweet and rich; quality, very good.

Early Bearing. Introduced from Cartersburg, Ind., where it ripens early in October; form, round ovate; size, medium; color, dull yellow; quality, good.

Early Golden. Origin, Illinois, where it ripens in September; form, oblong; size, medium to large; color, yellow; skin, thin; seeds, few; flavor, sweet; quality, very good.

Golden Gem. Introduced from Borden, Ind., where it ripens from August to October; form, roundish oblong; size, medium to large; color, dark orange to red; seeds, few; flavor, rich and sweet; quality, good.

Hicks. Origin, Washington County, Ind., where it ripens in October; form, roundish oblate; size, medium to large; color, dark red; skin, thin and tender; seeds, few; flavor, rich; quality, very good.

Josephine (*American Honey, Honey*). Origin near Bluffton, Mo., where it ripens in September; form, roundish oblate; size, medium; color, bright yellow, changing to pale translucent; skin, tough; seeds, few; flavor, sweet and rich; quality, good.

Kansas. Introduced from Missouri, where it ripens in September; form, roundish oblate; size, rather large; color, yellow splashed with red; flavor, rich; quality, very good.

Miller. Origin, Jackson County, Mo., where it ripens in September; form, roundish oblate; size, large; color, reddish yellow, translucent; skin, tough; seeds, rather numerous; flavor, sweet; quality, good.

Ruby (*Little's Ruby*). Introduced from Cartersburg, Ind., where it ripens during September and for some time later; form, roundish oblate; size, small to medium; color, yellowish red, shading to deep red; skin, tender; seeds, few; flavor, sweet; quality, very good.

Shoto. Introduced from Danville, Ind., where it ripens during October; form, oblong ovate; size, large; color, dull yellow, blushed in the sun; skin, rather tough; seeds, few; quality, very good.

Smeech. Introduced from Pennsylvania, where it ripens during October and November; form, roundish oblate; size, medium; color, dull yellow, splashed with red; flavor, rich and sweet; quality, very good.

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THE NATIVE PERSIMMON.

By W. F. FLETCHER,
Scientific Assistant, Office of Horticultural and Pomological Investigations, Bureau of Plant Industry.

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INTRODUCTION.

The persimmon seems to have been the first native American fruit to be described and praised by the early explorers. De Soto learned its food value in 1539, and in 1557 published an account of it at Evora, Portugal. The following year, 1558, Jan de Laet described the persimmon in his work on Virginia. John Smith's narrative of the settlements and resources of the New World, written during the first years of the seventeenth century, included a long discussion of the persimmon. In his reference to this fruit, where he says "If it be not ripe, it will draw a man's mouth awrie with much torment," he so well characterizes the puckering, astringent effect of the tannin contained in the immature fruit that no other comment is necessary.

The persimmon tree has received more criticism, both adverse and favorable, than almost any other known species. Those who have discussed the food value of the fruit, from the earliest chroniclers to recent writers, have prophesied that the tree would soon be accorded a place in our gardens and orchards. Those people, on the other hand, who have been acquainted only with the immature fruit or with the young sprouts in cultivated fields have had nothing to say

NOTE.—This is a general bulletin, intended for those to whom knowledge of the production, preparation, and uses of the native persimmon is of value.

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in its favor and have bent their energies toward its destruction rather than its propagation and cultivation.

There are several factors which are responsible for the slow progress of persimmon development in this country. One reason for the neglect of this fruit seems to be the erroneous yet oft-repeated statement that persimmons are unfit to eat until they have either been touched by frost or frozen. Although this statement has been corrected by nearly every one who has studied the subject, nevertheless throughout the regions where persimmons are grown many of the best fruits are lost each year because they ripen and fall before frost or before they are supposed to be edible. The truth of the matter is that freezing is as detrimental to the quality of persimmons as to the quality of any other fruit. If persimmons are not edible and free from astringency before frost, it is because the variety is a late one and the fruit has not yet matured.

The development of the persimmon, whether for orchard or ornamental purposes, has been retarded by the difficulty encountered in propagating and transplanting it. One grower has characterized it as the only tree that he could not kill in his cultivated fields and the only one that he could not make live in his garden. Failure in transplanting is usually due to a lack of knowledge concerning the characteristic root development of the persimmon. Under natural conditions, the roots penetrate much deeper into the soil than those of most other fruit trees, and unless great care is exercised when the tree is taken up it is almost impossible to get more than a small percentage of the root system, thus reducing the chance of making the tree live when transplanted.

From time to time valuable trees have been discovered, cared for, and even in some cases transplanted or propagated. Most of these have been soon neglected or destroyed, until there are comparatively few varieties of marked value available for general distribution.

Both De Soto and Jan de Laet when describing the ripe fruit of the native persimmon call it a "delicious little plum," and John Smith and other writers of the seventeenth century speak of it as a plum with the flavor of an apricot. This use of the word "plum" doubtless directed the attention of many people to the native species of Prunus, which include our wild cherries and plums.

BOTANICAL CLASSIFICATION.

The persimmon belongs to the ebony family (Ebenaceæ) and is known to botanists as *Diospyros virginiana*. It is the only member of the family which is indigenous to any extensive portion of this country.

NATURAL DISTRIBUTION OF THE PERSIMMON.

Roughly speaking, the persimmon is indigenous to the southeastern quarter of the United States, being found in large numbers

in the fields and forests of that section. The more favored localities in Iowa and eastern Nebraska produce many fruits, but very few trees are found west of central Kansas. Scattering specimens in Connecticut and on Long Island mark the present northeastern limit of the species. A few trees in Rhode Island, New York, and Michigan which produce fairly well indicate that the northern limit of cultivation may be extended whenever economic conditions (that is, the value of the fruit for food or of the tree for ornamental purposes) seem to warrant.

The zone of greatest productivity and adaptability, wherein appear by far the largest number of promising types, extends from Maryland, Virginia, and the Carolinas westward through Missouri and Arkansas. The persimmon thrives equally well on the sands of the Coastal Plain, the shales of the Allegheny Mountains, the muck of the river-bottom lands, and the chert of the Ozarks.

FIG. 1.—An old persimmon tree which shows the characteristic checking of the bark.

GENERAL DESCRIPTION OF THE PERSIMMON.

HABIT OF GROWTH.

Throughout the habitat of the persimmon there is a wide variation in the size and growth of the trees and in the form, size, color, and number of seeds of the fruit. The tree characters seem to indicate two types, upright and drooping, and these tree types are closely allied with the fruit types.

When grown in the open, persimmon trees rarely reach a height of 50 feet. In a dense forest growth they sometimes reach 70 or 100 feet, but that is uncommon. The characteristic checking of the bark of an old tree, which is shown in figure 1, aids one to recognize the species. The top of the tree is usually roundish or conical in form. Large trees are often somewhat irregular, owing to the breaking of limbs by heavy crops of fruit; moreover, it is a characteristic of productive trees to prune themselves by dropping many of the fruit-bearing twigs. The branches are always spreading, often

coming out almost at right angles to the trunk and then drooping more or less, especially after the tree has borne a few crops.

The leaves are elliptical or slightly ovate in form, acuminate at the apex, measuring from 3 to 6 inches in length and 1 to 3 inches in width, with a short petiole. In color, they are a dark glossy green on the upper surface and a grayish green underneath. Trees differ markedly, however, in habits of growth, as is shown in figures 2, 3, and 4.

FLOWERING HABIT.

The flowers resemble little four-lipped urns of wax, from one-fourth to three-fourths of an inch in length, the color varying from a greenish yellow to a milky white. They are borne on short stalks and appear from the last of April in the extreme South until the middle of June at the northern limit of the persimmon habitat.

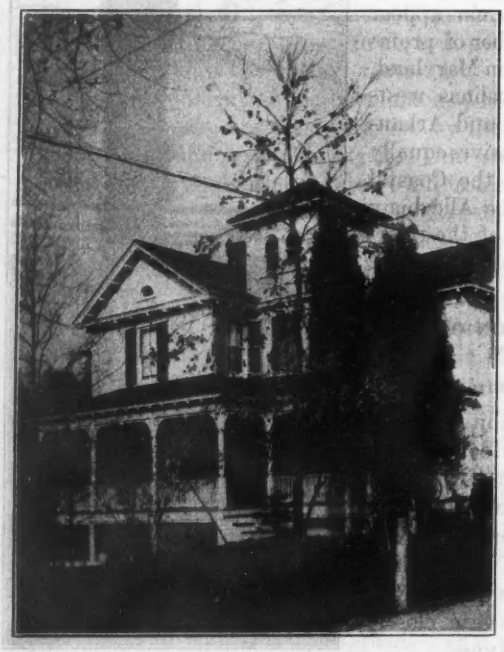

FIG. 2.—A persimmon tree of the upright type which produces large, oblate fruits and is here used as a dooryard tree.

The trees are generally dicœcious; that is, the pollen-bearing and fruit-producing flowers are borne on separate trees. The pistillate or fruit-producing flowers are borne singly, while the staminate or pollen-bearing flowers are generally produced in threes. The pollen is very light and powdery, and while it is generally distributed by the bees that frequent the trees in great numbers during blossoming time it can also be carried to great distances by the wind.

FRUIT CHARACTERS.

The fruit is a true berry, containing sometimes as many as eight seeds in its pale, translucent flesh. It varies in form from oblate to oblong and in diameter from three-fourths of an inch to 2 inches.

There is a wide range in color, varying from yellow to pale orange and even to a dark red, with many varietal markings, often blushed and covered with a bluish bloom. When green, persimmons are generally very astringent and puckery, because of the large quantity of tannin contained in the flesh, but when thoroughly mature and ripe the flavor is rich and sweet, and the consistency varies between that of a baked apple and a soft custard. The fruits of many late varieties turn a rich dark red and partially dry on the trees, somewhat resembling dates in appearance and flavor.

FIG. 3.—A persimmon tree of upright habit of growth which produces fruit of the pyriform type, ripening in midseason.

POSSIBILITIES OF IMPROVEMENT.

The season of the native persimmon is probably longer than that of any other wild fruit, both locally and over the country as a whole. In many sections the earliest and the latest varieties may be found growing side by side, or at least within a few miles of each other. The Bureau of Plant Industry has records for both early and late varieties from the southern part of Georgia and Florida. In the District of Columbia there are some trees which ripen their fruit in August and others on which it hangs until February.

Generally speaking, the best fruits are neither the earliest nor the latest, but rather those that ripen just before the beginning of the tree's dormant season. The latest varieties are still immature when the leaves fall or when they are killed by frost, and they must complete the ripening process within themselves instead of drawing nourishment from the tree until they have grown to maturity.

The largest as well as the best fruits are those that ripen about the time the trees shed their leaves. The early varieties are nearly all medium in size, and the late varieties which hang on until cold weather

are generally small. Seedless fruits, as a rule, are smaller and earlier than those with seeds produced on the same trees.

The wide variations shown by the fruit in size, color, season of maturity, and tendency to seedlessness, and by the trees in size, shape, and vegetative vigor indicate the possibility of greatly improving the native persimmon. Up to the present time one essential factor has been overlooked in all attempts at breeding better varieties. That factor is the parentage of the male or pollen-bearing trees. Without a knowledge of the characters represented in the male parent there is no certainty as to the results of the crossing and no possibility of the line breeding which is essential to the rapid development of improved varieties. Definite efforts should be made in breeding work to secure pollen-bearing trees of known parentage. They should be selected from among trees grown from seed produced on the most desirable fruit-bearing trees.

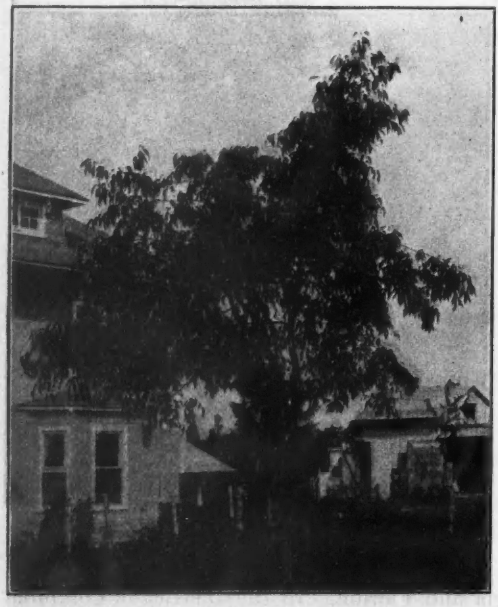

FIG. 4.—A persimmon tree which has a drooping habit of growth and produces fruit of the oblong type.

PRESENT STATUS OF THE NATIVE PERSIMMON.

Throughout the region where persimmons are found in abundance the fruit is considered as being "good for dogs, hogs, and 'possums." Occasionally a family is mentioned as having lived for several months upon the fruit from a single large tree. Twenty or thirty nurserymen are selling seedling trees for ornamental planting and half a dozen others have selected named varieties of special merit which they offer for the production of fruit.

In some of the large cities and towns within the persimmon habitat, the wild fruit can be purchased during the autumn and early winter from the dealers who occupy the open stalls in the public markets. A few enterprising growers adjacent to large cities have built up a demand which they find themselves unable to supply.

The methods of utilizing the persimmon are at present rather limited. Fresh fruit is used in various ways—in making a few forms of bread or pone, in preparing certain homemade beverages and sweetmeats, and as forage for the hogs and dogs which get most of their living from the woods.

The object of this publication is to set forth the best methods of propagating and cultivating persimmon trees, to call attention to the many trees worthy of propagation, to indicate the food value of the fruit, and to enumerate various ways in which persimmons may be prepared.

PROPAGATION OF THE PERSIMMON.

As is the case with most tree fruits, the persimmon does not reproduce its varietal characteristics through the seed, and other methods of propagation are, therefore, necessary to perpetuate desirable varieties. Propagation of the persimmon by the methods commonly employed with tree fruits is more difficult than for such fruits as the apple or the peach. The methods described below have been found successful in actual practice.

SEEDAGE.

The seeds of the persimmon are scattered by mammals and birds and in the natural sequence of events reach the ground in the fall or winter without becoming dry. They are lightly covered with grass or leaves and are subjected to the varying temperatures of winter, always remaining moist. The following spring the seeds sprout as soon as the soil becomes warm enough, provided that the conditions accompanying the rise in temperature do not dry them unduly. Seeds which fall under the trees are usually too much exposed to the atmosphere and dry too much to admit of germination.

Seeds that are gathered for propagating purposes should be stratified at once. If they are allowed to dry out it is often necessary to soak them for two or three days before they are planted, the water being renewed each day at a boiling temperature.

The seed bed in which persimmon seedlings are grown should be located on well-drained land where the soil is rather light and well supplied with humus. The ground should be plowed deep with a subsoil plow unless the subsoil is friable enough to permit the ready penetration of the long taproots which characterize the growth of persimmon seedlings.

The seed may be planted either in the fall or spring, after being treated as described above. It is commonly planted in shallow drills and lightly covered with soil to a depth of one-half inch or a little more.

CUTTAGE.

ROOT CUTTINGS.

The roots of persimmon trees sprout readily when the top is removed or when the main stem meets with serious injury. This is illustrated in figure 5, which shows the development of sprouts on the roots of a seedling tree two months after the removal of the top. During this period the seedling had been in a propagating bed in a greenhouse, under artificial heat. This illustration also offers an explanation for the occurrence of the large clumps of similar trees that are to be found in many abandoned fields. At some time the original tree was cut off near the surface of the ground and the roots sent up sprouts which, being undisturbed, developed into trees bearing similar fruit.

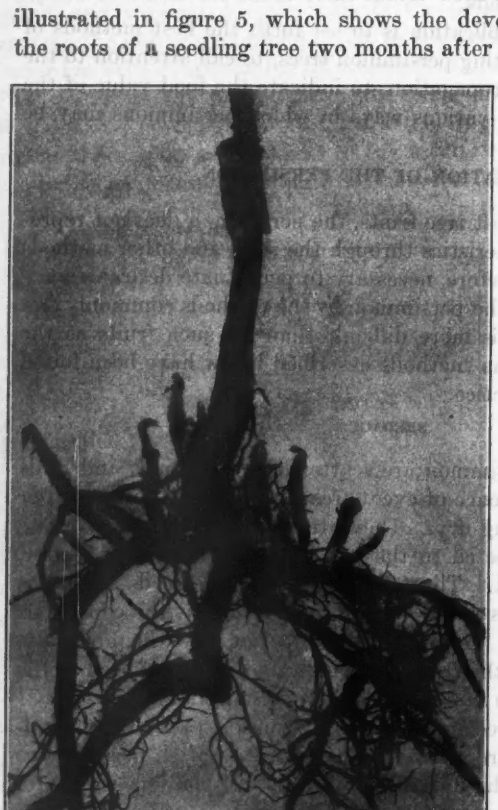

FIG. 5.—A 2-year-old seedling persimmon tree which has been grafted. It has been in a propagating bed in a greenhouse under artificial heat for two months. The sprouts on the roots show how easily the roots may be used as a means of propagating the variety.

Roots the size of a lead pencil or larger can be used in propagating the persimmon. They should be cut into pieces 6 or 8 inches long, the ends sealed with grafting wax, hot beeswax, or pitch, in order to prevent the decay that develops rapidly in the soft, spongy wood, and the cuttings should then be buried over winter in sand or in a nursery row. They will grow readily the following spring, provided the moisture supply is plentiful until they become well established.

WOOD CUTTINGS.

Cuttings of the branches may be treated in much the same way as root cuttings. Small twigs are unsuitable for purposes of propaga-

tion (1) because they lack sufficient substance to produce the callus and root formation and (2) because it is extremely difficult to prevent the organisms of decay from entering the soft, porous, 1-year-old wood. The cuttings should be waxed or pitched at both ends and buried until well callused and the roots have started. They may then be planted in a nursery row and vegetative growth encouraged.

Wood 2 or 3 years old may be selected for cuttings, but care must be exercised to procure good, strong buds. The cuttings may be taken at any time after the trees become dormant in the fall and may be placed in cold storage or in sand until wanted. It is most important, however, that the ends of the cuttings should be dipped immediately into melted wax in order to exclude the air. If they have been exposed for even a few hours they should be retrimmed and waxed before being put in cold storage or sand.

GRAFTAGE.

Those who have trees bearing exceptionally fine persimmons will find the different methods of grafting admirally adapted to top-working the worthless trees about the place with the better varieties, thus changing them to useful fruitfulness.

Top-worked, or grafted, portions of old trees will bear two or three years earlier than trees which come from buds or grafts on 1 or 2 year old stocks. These seedling stocks, budded or grafted with a selected variety, will bear one or two years earlier than those produced from cuttings.

The scions to be used in chip budding, cleft grafting, and whip grafting should be cut during late winter. All scions should be kept cool and moist until used. The budding and grafting should be done as soon as the trees which are to be grafted start to grow.

Because of the similarity in the operations of budding and grafting they are here treated together under the general heading of graftage. The various methods which have been found to be best adapted to the persimmon are here discussed.

SELECTION OF SCIONS AND BUD STICKS.

When selecting scions or bud sticks care must be exercised, just as when propagating by wood cuttings, to procure wood with strong, well-developed buds. On twigs of the last season's growth the best buds are generally near the base, where they are supported on more mature wood than those near the tip. In wood more than a year old, most of the buds near the tip have already produced branches, thus making this portion of the twig unsuitable for use in budding or grafting.

The method employed in budding persimmons largely determines the character of the wood that should be selected as a source of buds.

For the common shield or T bud, the basal half of the new growth is preferable because the bark is thinner than that on older wood and the buds fit closer and better than where wood with older and thicker bark is used. Moreover, the buds near the base of the new wood are better than those toward the tip, because the latter are so irregular in outline that it is difficult to fit them closely to the stock.

When the chip-bud method is used it is essential that the bud stick have sufficient body to allow the removal of the bud with a clean, solid chip adhering thereto. A bud stick should never be larger than the stock on which the buds are to be worked. If it is too large in relation to the size of the stock which is to receive the bud, the chip will be so broad and flat that it can not be properly fitted into any notch which it is possible to make in the stock.

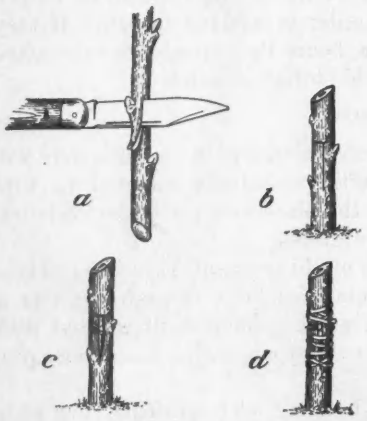

FIG. 6.—The different steps in shield or T budding: *a*, Cutting the bud; *b*, preparing the stock; *c*, inserting the bud; *d*, tying.

For annular or patch budding, the most satisfactory buds are those taken from wood that is 2, 3, or even 4 years old. Such buds are but lightly attached to the wood and have a good body of bark, which makes them easy to handle and not liable to dry out. Buds taken from near the base of large, vigorous, new shoots will also give good results.

The various methods of budding and grafting that have proved satisfactory in propagating the persimmon have been described in detail in publications of the Department of Agriculture relating to other fruits and to nuts. For convenience in the present connection, extracts from these publications are inserted below.

SHIELD OR "T" BUDDING.[1]

The height at which buds are inserted [where small seedling stocks are used] varies with the operator. In general, the nearer the ground the better. The cut for the reception of the bud is made in the shape of a letter T. (Fig. 6, *b*.) Usually the crosscut is not quite at right angles with the body of the tree, and the stem to the T starts at the crosscut and extends toward the root for an inch or more. The flaps of bark caused by the intersection of the two cuts are slightly loosened with the ivory heel of the budding knife, and the bud, grasped by the leaf stem as a handle, is placed under the flaps and firmly pushed in place until its cut surface is entirely in contact with the peeled body of the stock. (Fig. 6, *c*.) A ligature is then tightly drawn about, above, and below the bud, to hold it in place until a union shall be formed.

[1] Corbett, L. C. The propagation of plants. Farmers' Bulletin 157, pp. 22-23.

(Fig. 6, *d*.) Bands of raffia about 8 or 10 inches long make a most convenient tying material. As soon as the buds have united with the stock the ligature should be cut, in order to prevent girdling the stock. This done, the operation is complete until the following spring, when all the trees in which the buds have "taken" should have the top cut off just above the bud.

Shield budding may be done at any time when the trees are in vigorous growth and when well-matured buds of the current season's growth can be obtained. This period usually extends from July to September. When budding seedlings it may sometimes be necessary to delay the operation until the latter part of the season, in order that the stock may develop to a satisfactory size; but when top-working older trees by this method well-developed buds may be handled whenever the trees are in a vigorous condition of growth. Figure 7 shows a branch of a young persimmon tree on which a shield or T bud has made considerable growth.

FIG. 7.—A shield or T bud after considerable growth has been made.

Some of the precautions which it has been found important to observe when propagating pecans are equally applicable in the propagation of persimmons. The following directions for budding pecans according to the various methods are therefore presented here.[1]

ANNULAR BUDDING.

The process [of annular budding] is also known as "ring" and "flute" budding. It is performed during the midsummer months at such time as the bark is found to slip (release) most readily. In some seasons this period may be very brief, lasting only a few days, while in other years the time during which annular budding may be successfully performed extends over a period of several months. In the latitude of southern Georgia it is not uncommon for this method to be successful from as early as May 10 until late in July or even in August.

Annular budding consists merely in transferring a ring of bark to which is attached a bud of the desired variety from a bud stick[2] to the trunk or branch of another tree in place of a similar ring of bark previously removed. Specially designed tools have been devised for the purpose of cutting the rings. Two ordinary propagating knives having single blades may be fastened together and made to answer the purpose, although they are less liable to make uniform incisions. Cut a ring of bark from the stock with one of the tools, slit it with a single-bladed knife, and lift from its bed or "matrix," as it is technically called. Discard this bark and from the bud stick

[1] Reed, C. A. The pecan. Bureau of Plant Industry Bulletin 251, pp. 25–31.

[2] The bud stick is a branch cut from a tree of the variety to be propagated.

remove a similar ring, in the center of which is a dormant bud. The bark of the bud stick should be slit on the side opposite the bud. Immediately place this ring in the space left by removing the bark from the stock and wrap at once with waxed cloth, taking care not to cover the bud (fig. 8).

PATCH BUDDING.

When the annular method is used it is obvious that the stock and scion must be of nearly the same size. If the bud stick is slightly larger than the stock a portion of the bark to which the bud is attached may be cut away so that the two ends of the ring just meet around the stock. If the bud stick should be smaller than the stock, a strip of bark on the latter may be left in position to complete the ring. In actual practice, rings which extend only partly around the stock are most commonly used. Such process, however, is not true annular budding, because any bark which extends only partly around the stock is merely a patch. It is to this deviation from the annular method of budding that the term "patch budding" has been applied. A tool specially designed for patch budding consists of four thin steel blades fastened together in the form of a rectangle, five-eighths of an inch wide by 1 inch long, and is used as a punch.

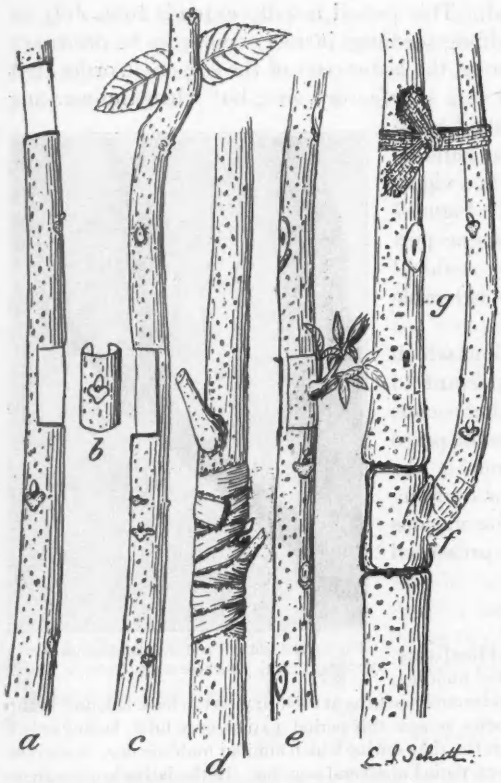

FIG. 8.—Annular budding. *a*, Bud stick from which the bud has been removed; *b*, the bud ready for insertion in the matrix of the stock; *c*, the stock ready to receive the bud; *d*, the bud after being placed in position and carefully wrapped; *e*, growth taking place, the wrapping having been removed; *f*, growth from the bud supported by being tied to the stock (*g*) above the union. Note the scars above the union, where the buds were removed in order to direct the flow of sap to the new bud.

A cut is made in the bark of the bud stick about half an inch in width by three times as long, in the center of which is the bud. The piece of bark so outlined is removed from the bud stick and laid over that of the stock. Using this as a pattern, incisions are then made around it in the bark of the stock. The pattern is then removed, the section of bark outlined in the stock is lifted, and the bark from the bud stick is put in its place. Some varieties of the pecan are more difficult to bud successfully than others; with such varieties the annular method, or a near approach to it, is generally most successful.

With the average sorts, however, the tendency among the more experienced nurserymen is much inclined to favor the patch method.

The buds best suited to annular or patch budding are those in the axils of the leaves at the base of the current season's growth. It is well worth the time required to clip the leaves away, close to the buds, 10 days or 2 weeks before the bud is wanted, for by so doing the wound will heal over before the bud is needed; otherwise a serious lessening of the vigor of the bud through evaporation may take place.

CARE OF ANNULAR AND PATCH BUDS.

In annular budding the added ring of bark sometimes unites with the stock promptly, permitting the upward flow of sap to proceed without much interference. When this is the case the top should be carefully pruned back to such a degree as is necessary to direct sufficient sap into the new bud to cause it to swell. This pruning should not be done with too great severity, as an oversupply of sap is liable to accumulate under the bark of the new bud and cause it to decay, or, as it is termed, "to drown" the bud. If the tree is young and the growth has been rapid, precaution should be exercised in cutting back the top, in order not to expose the tender bark to the heat of the sun. A sufficient amount of foliage should be left as a protection from the hot sun. If the supply of sap be limited, it will be well to cut out all buds in the top of the stock, as shown in figure 8. All dormant buds, both above and below the new bud, should be rubbed off as soon as they begin to swell. The wrapping about the new bud must be cut as soon as growth begins. As the union of a bud with a stock made by any method of budding is at first merely the uniting together of bark and not of wood, it is necessarily weak during the first few months. To avoid danger of breaking out at the bud, the new tops should be provided with extra support. For this purpose side stakes driven into the ground are sometimes used, but these are expensive and unnecessary. By leaving a stub of the original top 8 or 10 inches long, entirely denuded of foliage (fig. 8), the new top may be quickly tied to it, and when no longer needed the dead stub may be cut away close to the union.

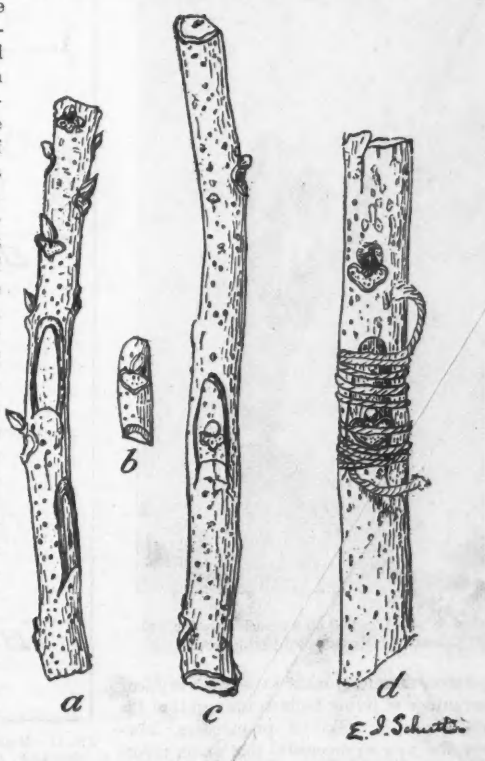

FIG. 9.—Chip or "dormant" budding. *a*, The bud stick; *b*, the bud ready for insertion; *c*, the bud inserted in the matrix of the stock; *d*, the bud securely tied in place.

CHIP BUDDING.

Propagation by chip budding is performed in the early spring or late in the dormant period. Because of being done at this season it is also known as "dormant" budding.

With a sharp knife a downward cut is made below the bud on the bud stick to a depth of perhaps one-eighth of an inch. Raising the knife to a point above the bud, a long downward cut is made, which meets the lower end of the first cut, and the bud is removed with a chip attached, as shown in figure 9. A similar chip is removed from the stock, and the desired bud is put in its place. This should be carefully wrapped with such material as will hold the cambium layers of the stock and the bud firmly together on at least one side.

Subsequent treatment similar to that already described for annular and patch budding should be given young trees propagated in this summer.

Trees of the pecan species are difficult to propagate asexually; that is, neither buds nor scions "take" with the readiness of ordinary fruit trees. The inexperienced

FIG. 10.—A chip bud on a branch after the bud inserted had made considerable growth.

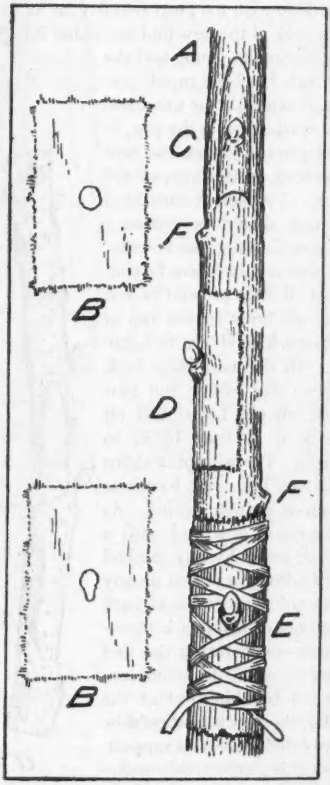

FIG. 11.—Method of using a bud protector on a chip bud. The protector may be used in a similar manner in all of the different forms of budding. *A*, stock; *B*, *B*, waxed cloth protectors; *C*, chip bud fitted into notch in stock; *D*, protector in position over the bud; *E*, protector and bud wrapped and tied; *F*, *F*, scars of buds removed from stock. (Adapted from drawing in American Fruit and Nut Journal, vol. 6, whole no. 94, p. 23.)

operator, therefore, must expect a very low percentage of living buds as the result of his first attempts. Skilled propagators, however, are now so successful that under favorable conditions the percentage of failures is no longer a matter of consequence.

No attempt to bud pecans should be made on rainy days, or in early mornings following heavy dews. Some nurserymen even go so far as to select their men for budding the pecan, assigning those who perspire most freely to other duties. Extremely hot days should be avoided, especially if accompanied by drying winds. Moderately cool, cloudy days without wind or rain are the best for pecan budding.

Figure 10 shows a persimmon chip bud which has made considerable growth.

PROTECTION OF BUDS.

A very satisfactory means of affording protection to buds inserted by any of the foregoing methods is shown in figure 11. These waxed shields are intended as a substitute for the waxed strips previously mentioned, and their preparation and use has been described as follows:[1]

In making the waxed wrappers, old domestic from worn bed sheets or undergarments may be used. Tear it into strips 2 feet long and 6 inches wide; then fold it into squares and dip it into a tin plate of hot, melted beeswax. The wax will strike through instantly, and then the strips may be held up by one end and the surplus wax allowed to drip back into the tin plate. When cool, the cloth may be torn into * * * squares of proper size. No pressing or squeezing is necessary. The beeswax answers the purpose in every way; its saves the buds, and that is the end in view. These

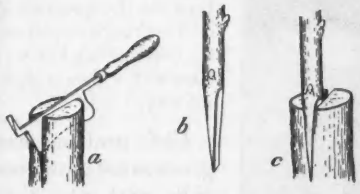

FIG. 12.—Cleft graft: *a*, Stock being split by special grafting tool; *b*, scion ready for insertion; *c*, scion in place ready for waxing.

wrappers may be left on the buds the whole season. When the bud shoots are an inch or so in length, the strings may be unwound from so much of the wrappers as cover the buds; but tie the upper end of the wrapper, which is above the bud, firmly to the projecting stub. The eyelets[2] in the wrappers will open as the bud shoots grow, and protection will be afforded against hot suns and chilly nights.

CLEFT GRAFTING.[3]

FIG. 13.—A cleft graft made on a small branch.

This style of graft is particularly adapted to large trees when for any reason it becomes necessary to change the variety. Branches too large to be worked by other methods can be cleft-grafted.

A branch 1 or 1½ inches in diameter is severed with a saw. Care should be taken that the bark be not loosened from any portion of the stub. Split the exposed end with a broad, thin chisel or grafting tool (fig. 12, *a*). Then with a wedge or the wedge-shaped prong at the end of the grafting tool spread the cleft so that the scions (fig. 12, *b*) may be inserted (fig. 12, *c*).

[1] American Fruit and Nut Journal, v. 6, no. 94, p. 22.

[2] The eyelet referred to is the small hole in the center of the protector shown in figure 11.

[3] Corbett, L. C. The propagation of plants. Farmer's Bulletin 157, pp. 17-18.

The scion should consist of a portion of the previous season's growth and should be long enough to have two or three buds. The lower end of the scion, which is to be inserted in the cleft, should be cut into the shape of a wedge, having the outer edge thicker than the other. In general, it is a good plan to cut the scion so that the lowest bud will come just at the top of this wedge, so that it will be near the top of the stock. The importance of having an intimate connection between the growing tissues of both scion and stock can not be too strongly emphasized, for upon this alone the success of grafting depends. To make this contact of the growing portions doubly certain, the scion is often set at a slight angle with the stock into which it is inserted, in order to cause the growing portions of the two to cross.

Fig. 14.—A cleft graft made at the crown, the soil which normally covered the union having been removed in order to show the parts to better advantage.

After the scions have been set the operation of cleft grafting is completed by covering all cut surfaces with a layer of grafting wax.

Cleft grafting has given satisfactory results with the persimmon, both on the branches (fig. 13) and at the crown (fig. 14).

WHIP GRAFTING.[1]

Whip grafting is the style almost universally used in root grafting. It has the advantage of being well adapted to small plants.

The graft is made by cutting the stock off diagonally—one long smooth cut with a sharp knife, as shown in figure 15, *a*. Place the knife about one-third of the distance from the end of the cut surface, at right angles to the cut, and split the stock in the direction of its long axis. Cut the lower end of the scion in like manner (fig. 15, *b*), and when the two parts are forced together, as shown in figure 15, *c*, the cut surfaces will fit neatly together, and one will nearly cover the other if the scion and stock are of

[1] Corbett, L. C. The propagation of plants. Farmers' Bulletin 157, pp. 18–19.

the same size. A difference in diameter of the two parts to be united may be disregarded unless it be too great. After the scion and stock have been locked together, as shown in figure 15, *c*, they should be wrapped with five or six turns of waxed cotton to hold the parts firmly together.

While top grafting may be done in this way (fig. 16), it is in root grafting that the whip graft finds its distinctive field. When the roots are cut into lengths of 2 to 5 or 6 inches to be used as stocks, the operation is known as piece-root grafting. Sometimes the entire root is used.

In ordinary propagation by means of whip grafts, the scion is cut with about three buds, and the stock is nearly as long as the scion. The graft is so planted as to bring the union of stock and scion not very far below the surface of the ground.

CARE OF WHIP GRAFTS.[1]

When grafted by the whip-graft method the young trees will require little subsequent attention other than pruning and ordinary cultivation. When the root is that of a very young tree there will be no danger of the supply of plant food being such as to induce a growth of top that is too rapid, as is frequently the case with cleft grafts, especially in the tops of old trees. While temporary staking as a support to the union is not necessary, in numerous cases stakes will be highly essential to insure erect growth. The moisture of the ground causes the wrapping material to decay in the course of a few weeks, and it is therefore not necessary to cut the bands.

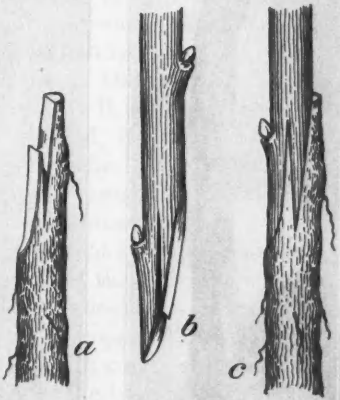

FIG. 15.—Whip graft: *a*, Stock prepared; *b*, scion prepared; *c*, stock and scion fitted together ready for tying.

The operation of grafting most fruits is generally successful if performed in the spring when the trees are still dormant, or even after growth has started slightly, provided the scions are entirely dormant. In the case of the persimmon, however, much more satisfactory results appear to be obtained when the grafting is delayed until the trees have definitely started into new growth. The scions must be kept dormant.

In all of the various methods of budding and grafting the persimmon it is of the utmost importance that the cut surfaces of both bark and wood be protected with as little delay as possible from chemical change due to exposure to the air. Protection is afforded by covering the wounds with grafting wax, waxed cloth, or similar devices.

STOCKS AND NURSERY TREES.

The stocks in the nursery row should stand at least 6 inches apart, to afford space for root development and to give the workmen plenty of room when the trees are budded or grafted. The young trees

[1] Reed, C. A. The pecan. Bureau of Plant Industry Bulletin 251, p. 25.

in the nursery should receive fair cultivation, and the roots should be pruned each year with a tree digger or spade in order to keep the root system small enough to be handled with ease when the trees are dug. The 2-year-old roots are always preferable for stocks. Older roots which are small enough to be easily handled are likely to be stunted, and 1-year-old roots must be very thrifty to produce the desired growth in the graft.

FIG. 16.—A whip graft after attaining considerable growth.

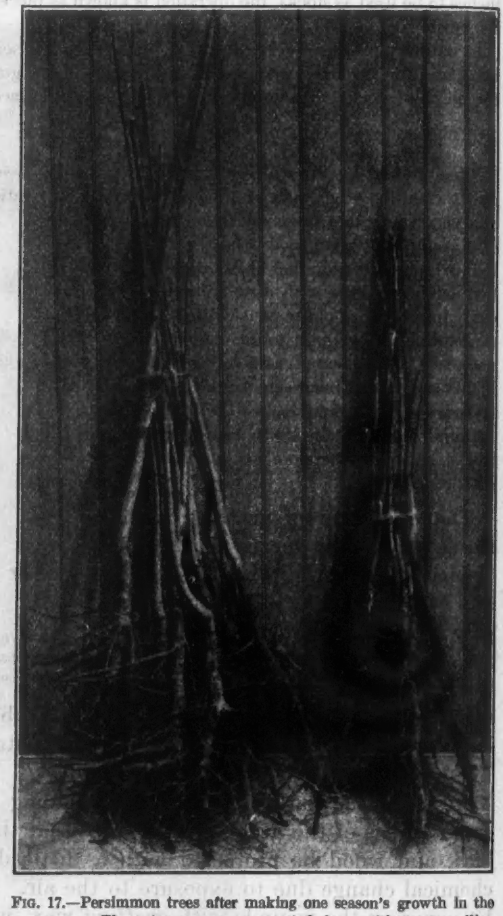

FIG. 17.—Persimmon trees after making one season's growth in the nursery. These trees were propagated by grafting on seedling stocks. The bundle on the left is the Golden Gem variety; on the right, the Miller. The largest trees are 4 to 5 feet tall. The difference in the size of the trees in the two bundles is due to the difference in the natural vigor of growth of these two sorts.

Trees which have been produced under conditions favorable for development may be planted in their permanent location after they have made one season's growth in the nursery. Some varieties, however, are much more vigorous than others. It may be advisable to grow the weaker sorts in the nursery for two years

before transplanting them. Figure 17 shows two varieties of grafted persimmon trees that have made one season's growth in the nursery.

On account of the very long taproot which persimmon trees habitually develop, particularly when propagated on seedling stocks, much care must be exercised to avoid undue injury to the root systems when the trees are dug from the nursery. Moreover, because of the deep-rooting habits of these trees a deep soil should be selected for their permanent location.

CULTIVATION OF THE PERSIMMON.

PLANTING.

The transplanting of the young trees may be done at any time during the dormant period, from late autumn to early spring, when the roots can be protected from freezing temperatures and evaporation and when the soil is in a suitable condition for handling. If the trees have been properly taken up without undue injury to the roots, the tops will need little or no pruning. If, on the other hand, the root systems have been severely reduced, the tops should be headed back until the total length of branches and trunks corresponds in a general way to the total length of the main roots. Wounds on both tops and roots should be waxed as soon as made.

Young persimmon trees have large, deep root systems and should be planted 2 or 3 inches deeper in the orchard than they were in the nursery row. In setting them out the soil should be packed thoroughly around the roots. A round-pointed wooden tamp is a very serviceable tool with which to make the earth compact as the hole is filled up. The planting plan varies with the type of tree desired. If it seems desirable to grow low-headed trees with the expectation of producing large fruit that can be readily picked by hand, the permanent trees should be placed at least 16 or, better still, 20 feet apart each way. If, however, a large bulk of fruit is desired as stock feed to be scraped from the ground or picked up by animals, a fair degree of success may be expected if the trees are planted 10 feet apart each way.

TILLAGE.

Probably the persimmon can be more successfully intercropped than any other fruit tree, owing to the depth of its root system. Blackberries, dewberries, strawberries, and vegetables thrive very well among persimmons until the shade becomes too dense. When the trees shade the ground, it is best to seed down the orchard if it is to be used as a run for chickens, calves, pigs, or other animals and the fruit used as stock feed. If it is planned to produce fruit for market purposes, however, the same cultivation should be given the ground as in a commercial orchard of peach or other fruit trees.

PRUNING.

The pruning of the persimmon varies with the variety. There is a tendency for the tree to prune itself, as many of the fruit-bearing twigs die and drop off with their fruit, thus making the natural open growth of the trees still more open and reducing to a minimum the necessity for pruning. There are two points, however, which should be borne in mind: (1) The upright tendency of some of the most vigorous varieties should be checked by pinching off the tender growing tips as they get out of reach, and (2) those trees that do not prune themselves sufficiently to keep the top well open should be thinned by removing entire limbs either main or secondary. This practice is preferable to opening the tops by thinning out the small branches and thus leaving the larger limbs bare for a considerable portion of their length. Thinning admits light and air, and at the same time a stronger vegetative growth is induced; the result is that the size of the fruit is kept uniform and the crops are made more regular by reducing the tendency to overbear on alternate years.

All wounds should be painted or otherwise covered as soon as made, in order to prevent the wood from drying or dying back and decay from entering the body of the trees.

DISEASES AND INSECT PESTS.

The persimmon is exceptionally free from the attacks of diseases and insect pests. Probably the most important of the insect enemies of the persimmon is the hickory twig girdler. The following brief account of the life history and habits of this insect, prepared for this bulletin by the Bureau of Entomology, may be of interest to those who anticipate growing the persimmon:

The hickory twig girdler, *Oncideres cingulata* Say, makes its appearance about the middle of August and may be found until the first of October. It begins depositing its eggs about the latter part of August and continues the process well into October. The eggs hatch in from seven to nine days after deposition, and the young larva begins to feed on the inner bark and wood at the point where the egg was inserted beneath the bark. As the larva increases in size it continues to feed on the wood, going deeper into the twig, and by the time its full growth has been attained it often completely hollows out the twig for some little distance from the point where it began work. Some of the larvæ attain their full growth and begin transformation to pupæ about the first of August. Others do not make this change until near the middle of September. The pupal stage lasts from 10 to 14 days, when the insects transform to adults and emerge from the twigs where they have spent their lives. Several days pass before they begin laying their eggs in the small limbs and twigs.

The injury caused by this insect occurs in the process of oviposition. The adult gnaws a small hole in the bark, usually just above or just below a bud, and the egg is inserted beneath the bark by means of the ovipositor. Several eggs are usually deposited in a twig in this manner, and the insect then begins girdling the twig beneath the point of oviposition by gnawing out small pieces of the bark. A ring is thus made around the twig, perhaps a third of the way through, weakening it to such an extent that it is broken off by the wind during the winter or the following spring. The trees are often severely injured by having the young growth pruned off in this manner.

In order to control this insect the twigs should be picked up from the ground in June or early July. All twigs which are found at this time have been girdled and broken from the tree and should be collected and burned in order to destroy the insects which are inside them.

USES OF THE PERSIMMON TREE.

The largest purchases of persimmon wood are made by the manufacturers of cotton-mill supplies, who use the timber in making bobbins. The wood is well suited for this work, as it is strong, comparatively light, hard, elastic, and close grained, taking a high polish. Shoe lasts are also made to some extent from persimmon wood.

The tree has some value for shade and ornamental purposes. Concerning this use of the native persimmon Mr. F. L. Mulford, landscape gardener of the Department of Agriculture, writes as follows:

As an ornamental for lawns the persimmon compares favorably with any of the shade trees used on private grounds, provided that it does not overhang a sidewalk, where the dropping of fruits would be objectionable. The broad, glossy leaves on the gracefully drooping branches give a dense shade from early in the spring until the autumn is well advanced.

In the early summer the little waxlike flowers fill the air with a delicious fragrance, somewhat resembling that of the calla lily. When the fruit begins to mature, yellowish and golden clusters appear among the dark-green leaves and add to the beauty of the tree until they fall. Some of the later varieties are ornamental after the leaves have fallen and even until well into the winter.

USES OF THE PERSIMMON FRUIT.

The only fruit which equals the persimmon in food value is the date. This is shown by the analyses presented in Table I.

TABLE I.—*Comparative analyses of fresh fruits, showing their food values in percentages of the weight of the fruit.*[1]

Fruit.	Total solids.	Ash.	Protein.	Sugars.	Crude fiber.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Apples	13.65	0.28	0.69	10.26	0.96
Blackberries	13.59	.48	.51	4.44	5.21
Cherries	22.30	.65	.81	11.72	.62
Currants	15.23	.72	.51	6.38	4.57
Dates	[2][3] 66.86	[4] 1.20	[5] 1.48	[6] 56.59	[7] 3.80
Figs	20.13	.57	1.34	15.51	.....
Grapes [8]	[2] 21.83	.53	.59	[9] 17.11	3.60
Oranges (Navel)	13.87	.43	.48	15.91	.....
Peaches [7]	[3] 10.60	.40	.70	[6] 5.90	3.60
Pears	16.97	.31	.36	8.26	4.30
Persimmons [10]	[2] 35.17	.78	.88	[9] 31.74	1.43
Plums	15.14	.61	.40	3.56	4.34
Raspberries	13.79	.49	.53	3.95	5.90
Strawberries	9.48	.60	.97	5.36	1.51

[1] Data, with exceptions as noted, from Bureau of Chemistry Bulletin 66, pp. 41–42.
[2] Dry matter.
[3] Average of 11 analyses. See "Chemistry and ripening of the date," Arizona Agricultural Experiment Station Bulletin 66, p. 408.
[4] See "Principles of nutrition and nutritive value of food," Farmers' Bulletin 142, p. 18.
[5] Adapted from the two publications mentioned in footnotes 3 and 4.
[6] Fats and carbohydrates.
[7] See "Use of fruit as food," Farmers' Bulletin 293, p. 14.
[8] See "The American persimmon," Indiana Experiment Station Bulletin 60 (1896), p. 52.
[9] Nitrogen-free extract.
[10] Average of 6 analyses in "The American persimmon," Indiana Experiment Station Bulletin 60 (1896).

Probably the most common use of the fruit is as feed for hogs. As a rule, the hogs are merely turned loose in lots where persimmon trees have come up naturally. Some, however, who appreciate the value of this fruit as stock feed have set out orchards in order to provide a definite supply for this purpose. If varieties are selected which ripen in a continuous sequence, the fruit will, in some sections, furnish forage for hogs from the last of August until early winter. A small area devoted to persimmons can thus be made a valuable asset for any general farm located in a persimmon district which includes hogs among its stock.

The persimmon fruits intended for shipment should, to avoid bruising, be carefully hand picked while still quite firm, that is, just as the flesh begins to soften. Fruits which can be delivered direct to the consumer should not be picked until fully mature and should also be handled with great care. Fruit of the later varieties, especially those of the oblong type, often hang on the trees for weeks, drying to about the consistency of the commercial date.

Quart and pint size berry boxes are commonly used when packing the fruit for market, the baskets being handled in the ordinary strawberry crates. Larger units would result in bruising the softer fruits and are therefore not advisable. Crates in which the individual fruits are placed in separate compartments are suggested for shipping the better grades of persimmons, and it is believed that a trade which will fully repay the expense and trouble of this method of handling can be built up in any town of moderate size. Persimmons which are placed in storage should be packed in egg crates or similar containers that hold the fruits separate.

RECIPES FOR USING PERSIMMONS.

Before the advent of the white man, the Indians mixed the pulp of this fruit with crushed corn and made it into a kind of bread. Now, there are many ways in which the fruit can be used, but the different methods are not well known, and many people with fine trees in their possession are allowing the fruit to waste because they do not realize its value. The dissemination of knowledge regarding the use of the persimmon in preparing very palatable food products should result in much wider use of the fruit. To this end a number of recipes are included in this publication.

Since heat makes the astringency of the persimmon more apparent, it is always well to add one-half teaspoonful of baking soda (bicarbonate of soda) to each cupful of persimmon pulp in all recipes where the fruit is subjected to heat. Although it has been proved by experiment that the soda may be omitted if the fruit is entirely free from astringency, it is better to use it until one is sure of the quality of the persimmon pulp.

PERSIMMON BREAD.

1 cup of persimmon pulp.
1 cup of water.
½ teaspoonful of soda.
Yeast.
Shortening.
Flour to make a stiff dough.

Set to rise, mold, and bake like other bread.

PERSIMMON CRUMPETS.

Take 1 pint of the sponge of persimmon bread which has been set over night, add 1 egg and enough milk to make a thin batter, set to rise for one hour, then bake on a hot griddle like griddlecakes. Serve hot with butter or sirup.

PERSIMMON GRIDDLECAKES.

1 cup of persimmon pulp.
1 egg.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.
Milk to make a thin batter.

Bake and serve as above.

PERSIMMON-PEANUT GRIDDLECAKES.

1 cup of persimmon pulp.
1 tablespoonful of peanut butter.
1 egg.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.
Milk to make a thin batter.

Bake and serve as above.

PERSIMMON-PEANUT MUFFINS (A GOOD RECIPE FOR CAMPERS).

½ cup of persimmon pulp.
1 tablespoonful of peanut butter.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.

Press or cut in pats ½ inch thick and bake in a quick oven.

COFFEE FRUIT CAKE.

Boil together 1 cup of molasses and 1½ cups of minced dried persimmons for five minutes. Cream 1 cup of sugar, ½ cup of butter and 1 egg, and add to the above. Stir in three-fourths of a cup of strong coffee and place on a warm stove. Add 2 cups of flour; 1½ teaspoonfuls of mixed ground spice; 1½ teaspoonfuls of a phosphate baking powder, or, if preferred, 1 teaspoonful of baking powder and ½ teaspoonful of soda. Bake in a moderate or slow oven 40 minutes to 1 hour.

PERSIMMON CAKE.

1 cup of persimmon pulp.
½ cup of sugar.
1 egg.
Butter of size of a walnut.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.

Bake 40 minutes in a moderate oven. For a soft pudding leave out the eggs. For a custard leave out the flour and the baking powder.

PERSIMMON PUDDING (CAKE OR PONE).[1]

1 pint of fine persimmon pulp.
1 cup of sugar.
1 quart of sweet milk.
3 cups of flour.
1 teaspoonful of ground cinnamon.
2 teaspoonfuls of baking powder.

PRESERVED PERSIMMON PULP.

Place equal amounts of persimmon pulp and sugar in glass or earthenware jars or in coated sanitary cans. (Never use cans of uncoated tin for persimmons.) Mix thoroughly and set in a cool, light place. Stir occasionally until the air is removed and seal with paraffin or waxed paper. The cans may be heated over a slow fire, just enough to drive out the air, and should be sealed at once.

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[1] The American persimmon. Indiana Experiment Station Bulletin 60, pp. 43-54, 1896.

PRESERVED WHOLE PERSIMMONS.

Put a thin layer of sugar in the bottom of a jar; then a layer of whole ripe persimmons, then a layer of sugar; and so on until the jar is full. The sugar will soon dissolve and form a sirup. Press the upper fruits down under the sirup or add more sirup to the jars. Seal and store until used. The sirup may be drained off and the fruits served like dates, which they will resemble in appearance and flavor.

PERSIMMON LEATHER.

Spread a thin layer of ripe persimmon pulp on waxed paper or on a large platter. Dry in the sun, in a fruit evaporator, or in the oven of a stove, leaving the oven doors open. Remove the seeds. Add another layer of pulp, and repeat until the leather is of a thickness to handle easily. This may be diced or minced and used instead of raisins or citron in fruit cakes, cookies, or puddings.

PERSIMMON ICE CREAM.

2 cups of persimmon pulp. 1 cup of thick, sweet cream.

Beat together thoroughly and freeze like ordinary ice cream. The fruit must be thoroughly ripe and nonastringent.

PERSIMMON FRUIT ICE.

2 cups of persimmon pulp. 1 cup of sugar.

Beat to a creamy pulp and freeze.

PERSIMMON TAFFY.

Two cups of the sirup from the preserved whole persimmons. Add 1 cup of sugar and cook until it forms a hard ball in water. Pour on a buttered platter and pull. Cut in sticks and squares.

PERSIMMON FUDGE.

2 cups of persimmon pulp. 2 cups of sugar.

Cook over a slow fire, stirring occasionally, until graining begins. Add 1 teaspoonful of baking soda and stir over the fire until quite stiff. Spread on buttered platter or paraffin paper.

SELECTED AND CULTIVATED NAMED VARIETIES.

The native persimmon varieties that have been named and disseminated for cultivation originated as chance seedlings. With few exceptions, the fruits are of the oblate type. Brief descriptions of the fruit of some of the better-known varieties follow.

DESCRIPTIONS OF VARIETIES.

Early Golden. Origin, Illinois, where it ripens in September; form, oblong; size, medium to large; color, yellow; skin, thin; seeds, few; flavor, sweet; quality, very good.

Golden Gem. Introduced from Borden, Ind., where it ripens from August to October; form, roundish oblong; size, medium to large; color, dark orange to red; seeds, few; flavor, rich and sweet; quality, good.

Hicks. Origin, Washington County, Ind., where it ripens in October; form, roundish oblate; size, medium to large; color, dark red; skin, thin and tender; seeds, few; flavor, rich; quality, very good.

Josephine (*American Honey, Honey*). Origin near Bluffton, Mo., where it ripens in September; form, roundish oblate; size, medium; color, bright yellow, changing to pale translucent; skin, tough; seeds, few; flavor, sweet and rich; quality, good.

Miller. Origin, Jackson County, Mo., where it ripens in September; form, roundish oblate; size, large; color, reddish yellow, translucent; skin, tough; seeds, rather numerous; flavor, sweet; quality, good.

Ruby (*Little's Ruby*). Introduced from Cartersburg, Ind., where it ripens during September and for some time later; form, roundish oblate; size, small to medium; color, yellowish red, shading to deep red; skin, tender; seeds, few; flavor, sweet; quality, very good.

Other varieties, including the Ford, Garretson, Glidewell, and Leona, have received names, but it is doubtful in many cases whether trees are now available.

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THE NATIVE PERSIMMON.

By W. F. FLETCHER,

Scientific Assistant, Office of Horticultural and Pomological Investigations, Bureau of Plant Industry.

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INTRODUCTION.

The persimmon seems to have been the first native American fruit to be described and praised by the early explorers. De Soto learned its food value in 1539, and in 1557 published an account of it at Evora, Portugal. The following year, 1558, Jan de Laet described the persimmon in his work on Virginia. John Smith's narrative of the settlements and resources of the New World, written during the first years of the seventeenth century, included a long discussion of the persimmon. In his reference to this fruit, where he says "If it be not ripe, it will draw a man's mouth awrie with much torment," he so well characterizes the puckering, astringent effect of the tannin contained in the immature fruit that no other comment is necessary.

The persimmon tree has received more criticism, both adverse and favorable, than almost any other known species. Those who have discussed the food value of the fruit, from the earliest chroniclers to recent writers, have prophesied that the tree would soon be accorded a place in our gardens and orchards. Those people, on the other hand, who have been acquainted only with the immature fruit or with the young sprouts in cultivated fields have had nothing to say

NOTE.—This is a general bulletin, intended for those to whom knowledge of the production, preparation, and uses of the native persimmon is of value.

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in its favor and have bent their energies toward its destruction rather than its propagation and cultivation.

There are several factors which are responsible for the slow progress of persimmon development in this country. One reason for the neglect of this fruit seems to be the erroneous yet oft-repeated statement that persimmons are unfit to eat until they have either been touched by frost or frozen. Although this statement has been corrected by nearly every one who has studied the subject, nevertheless throughout the regions where persimmons are grown many of the best fruits are lost each year because they ripen and fall before frost or before they are supposed to be edible. The truth of the matter is that freezing is as detrimental to the quality of persimmons as to the quality of any other fruit. If persimmons are not edible and free from astringency before frost, it is because the variety is a late one and the fruit has not yet matured.

The development of the persimmon, whether for orchard or ornamental purposes, has been retarded by the difficulty encountered in propagating and transplanting it. One grower has characterized it as the only tree that he could not kill in his cultivated fields and the only one that he could not make live in his garden. Failure in transplanting is usually due to a lack of knowledge concerning the characteristic root development of the persimmon. Under natural conditions, the roots penetrate much deeper into the soil than those of most other fruit trees, and unless great care is exercised when the tree is taken up it is almost impossible to get more than a small percentage of the root system, thus reducing the chance of making the tree live when transplanted.

From time to time valuable trees have been discovered, cared for, and even in some cases transplanted or propagated. Most of these have been soon neglected or destroyed, until there are comparatively few varieties of marked value available for general distribution.

Both De Soto and Jan de Laet when describing the ripe fruit of the native persimmon call it a "delicious little plum," and John Smith and other writers of the seventeenth century speak of it as a plum with the flavor of an apricot. This use of the word "plum" doubtless directed the attention of many people to the native species of Prunus, which include our wild cherries and plums.

BOTANICAL CLASSIFICATION.

The persimmon belongs to the ebony family (Ebenaceæ) and is known to botanists as *Diospyros virginiana*. It is the only member of the family which is indigenous to any extensive portion of this country.

NATURAL DISTRIBUTION OF THE PERSIMMON.

Roughly speaking, the persimmon is indigenous to the southeastern quarter of the United States, being found in large numbers

in the fields and forests of that section. The more favored localities in Iowa and eastern Nebraska produce many fruits, but very few trees are found west of central Kansas. Scattering specimens in Connecticut and on Long Island mark the present northeastern limit of the species. A few trees in Rhode Island, New York, and Michigan which produce fairly well indicate that the northern limit of cultivation may be extended whenever economic conditions (that is, the value of the fruit for food or of the tree for ornamental purposes) seem to warrant.

The zone of greatest productivity and adaptability, wherein appear by far the largest number of promising types, extends from Maryland, Virginia, and the Carolinas westward through Missouri and Arkansas. The persimmon thrives equally well on the sands of the Coastal Plain, the shales of the Allegheny Mountains, the muck of the river-bottom lands, and the chert of the Ozarks.

FIG. 1.—An old persimmon tree which shows the characteristic checking of the bark.

GENERAL DESCRIPTION OF THE PERSIMMON.

HABIT OF GROWTH.

Throughout the habitat of the persimmon there is a wide variation in the size and growth of the trees and in the form, size, color, and number of seeds of the fruit. The tree characters seem to indicate two types, upright and drooping, and these tree types are closely allied with the fruit types.

When grown in the open, persimmon trees rarely reach a height of 50 feet. In a dense forest growth they sometimes reach 70 or 100 feet, but that is uncommon. The characteristic checking of the bark of an old tree, which is shown in figure 1, aids one to recognize the species. The top of the tree is usually roundish or conical in form. Large trees are often somewhat irregular, owing to the breaking of limbs by heavy crops of fruit; moreover, it is a characteristic of productive trees to prune themselves by dropping many of the fruit-bearing twigs. The branches are always spreading, often

coming out almost at right angles to the trunk and then drooping more or less, especially after the tree has borne a few crops.

The leaves are elliptical or slightly ovate in form, acuminate at the apex, measuring from 3 to 6 inches in length and 1 to 3 inches in width, with a short petiole. In color, they are a dark glossy green on the upper surface and a grayish green underneath. Trees differ markedly, however, in habits of growth, as is shown in figures 2, 3, and 4.

FLOWERING HABIT.

The flowers resemble little four-lipped urns of wax, from one-fourth to three-fourths of an inch in length, the color varying from a greenish yellow to a milky white. They are borne on short stalks and appear from the last of April in the extreme South until the middle of June at the northern limit of the persimmon habitat.

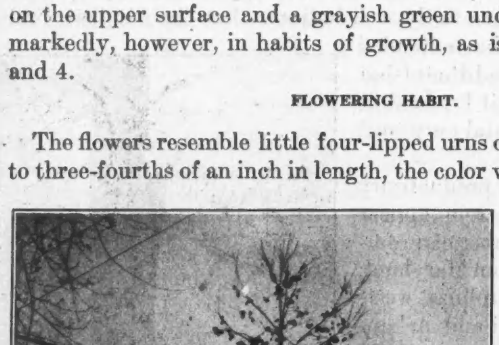

FIG. 2.—A persimmon tree of the upright type which produces large, oblate fruits and is here used as a dooryard tree.

The trees are generally dicœcious; that is, the pollen-bearing and fruit-producing flowers are borne on separate trees. The pistillate or fruit-producing flowers are borne singly, while the staminate or pollen-bearing flowers are generally produced in threes. The pollen is very light and powdery, and while it is generally distributed by the bees that frequent the trees in great numbers during blossoming time it can also be carried to great distances by the wind.

FRUIT CHARACTERS.

The fruit is a true berry, containing sometimes as many as eight seeds in its pale, translucent flesh. It varies in form from oblate to oblong and in diameter from three-fourths of an inch to 2 inches.

There is a wide range in color, varying from yellow to pale orange and even to a dark red, with many varietal markings, often blushed and covered with a bluish bloom. When green, persimmons are generally very astringent and puckery, because of the large quantity of tannin contained in the flesh, but when thoroughly mature and ripe the flavor is rich and sweet, and the consistency varies between that of a baked apple and a soft custard. The fruits of many late varieties turn a rich dark red and partially dry on the trees, somewhat resembling dates in appearance and flavor.

FIG. 3.—A persimmon tree of upright habit of growth which produces fruit of the pyriform type, ripening in midseason.

POSSIBILITIES OF IMPROVEMENT.

The season of the native persimmon is probably longer than that of any other wild fruit, both locally and over the country as a whole. In many sections the earliest and the latest varieties may be found growing side by side, or at least within a few miles of each other. The Bureau of Plant Industry has records for both early and late varieties from the southern part of Georgia and Florida. In the District of Columbia there are some trees which ripen their fruit in August and others on which it hangs until February.

Generally speaking, the best fruits are neither the earliest nor the latest, but rather those that ripen just before the beginning of the tree's dormant season. The latest varieties are still immature when the leaves fall or when they are killed by frost, and they must complete the ripening process within themselves instead of drawing nourishment from the tree until they have grown to maturity.

The largest as well as the best fruits are those that ripen about the time the trees shed their leaves. The early varieties are nearly all medium in size, and the late varieties which hang on until cold weather

are generally small. Seedless fruits, as a rule, are smaller and earlier than those with seeds produced on the same trees.

The wide variations shown by the fruit in size, color, season of maturity, and tendency to seedlessness, and by the trees in size, shape, and vegetative vigor indicate the possibility of greatly improving the native persimmon. Up to the present time one essential factor has been overlooked in all attempts at breeding better varieties. That factor is the parentage of the male or pollen-bearing trees. Without a knowledge of the characters represented in the male parent there is no certainty as to the results of the crossing and no possibility of the line breeding which is essential to the rapid development of improved varieties. Definite efforts should be made in breeding work to secure pollen-bearing trees of known parentage. They should be selected from among trees grown from seed produced on the most desirable fruit-bearing trees.

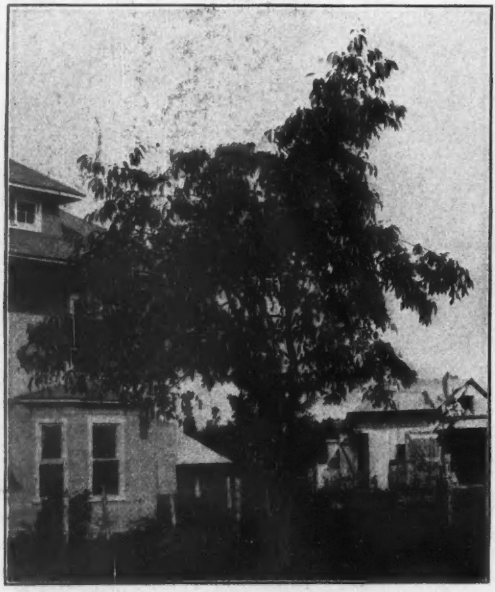

FIG. 4.—A persimmon tree which has a drooping habit of growth and produces fruit of the oblong type.

PRESENT STATUS OF THE NATIVE PERSIMMON.

Throughout the region where persimmons are found in abundance the fruit is considered as being "good for dogs, hogs, and 'possums." Occasionally a family is mentioned as having lived for several months upon the fruit from a single large tree. Twenty or thirty nurserymen are selling seedling trees for ornamental planting and half a dozen others have selected named varieties of special merit which they offer for the production of fruit.

In some of the large cities and towns within the persimmon habitat, the wild fruit can be purchased during the autumn and early winter from the dealers who occupy the open stalls in the public markets. A few enterprising growers adjacent to large cities have built up a demand which they find themselves unable to supply.

The methods of utilizing the persimmon are at present rather limited. Fresh fruit is used in various ways—in making a few forms of bread or pone, in preparing certain homemade beverages and sweetmeats, and as forage for the hogs and dogs which get most of their living from the woods.

The object of this publication is to set forth the best methods of propagating and cultivating persimmon trees, to call attention to the many trees worthy of propagation, to indicate the food value of the fruit, and to enumerate various ways in which persimmons may be prepared.

PROPAGATION OF THE PERSIMMON.

As is the case with most tree fruits, the persimmon does not reproduce its varietal characteristics through the seed, and other methods of propagation are, therefore, necessary to perpetuate desirable varieties. Propagation of the persimmon by the methods commonly employed with tree fruits is more difficult than for such fruits as the apple or the peach. The methods described below have been found successful in actual practice.

SEEDAGE.

The seeds of the persimmon are scattered by mammals and birds and in the natural sequence of events reach the ground in the fall or winter without becoming dry. They are lightly covered with grass or leaves and are subjected to the varying temperatures of winter, always remaining moist. The following spring the seeds sprout as soon as the soil becomes warm enough, provided that the conditions accompanying the rise in temperature do not dry them unduly. Seeds which fall under the trees are usually too much exposed to the atmosphere and dry too much to admit of germination.

Seeds that are gathered for propagating purposes should be stratified at once. If they are allowed to dry out it is often necessary to soak them for two or three days before they are planted, the water being renewed each day at a boiling temperature.

The seed bed in which persimmon seedlings are grown should be located on well-drained land where the soil is rather light and well supplied with humus. The ground should be plowed deep with a subsoil plow unless the subsoil is friable enough to permit the ready penetration of the long taproots which characterize the growth of persimmon seedlings.

The seed may be planted either in the fall or spring, after being treated as described above. It is commonly planted in shallow drills and lightly covered with soil to a depth of one-half inch or a little more.

CUTTAGE.

ROOT CUTTINGS.

The roots of persimmon trees sprout readily when the top is removed or when the main stem meets with serious injury. This is illustrated in figure 5, which shows the development of sprouts on the roots of a seedling tree two months after the removal of the top. During this period the seedling had been in a propagating bed in a greenhouse, under artificial heat. This illustration also offers an explanation for the occurrence of the large clumps of similar trees that are to be found in many abandoned fields. At some time the original tree was cut off near the surface of the ground and the roots sent up sprouts which, being undisturbed, developed into trees bearing similar fruit.

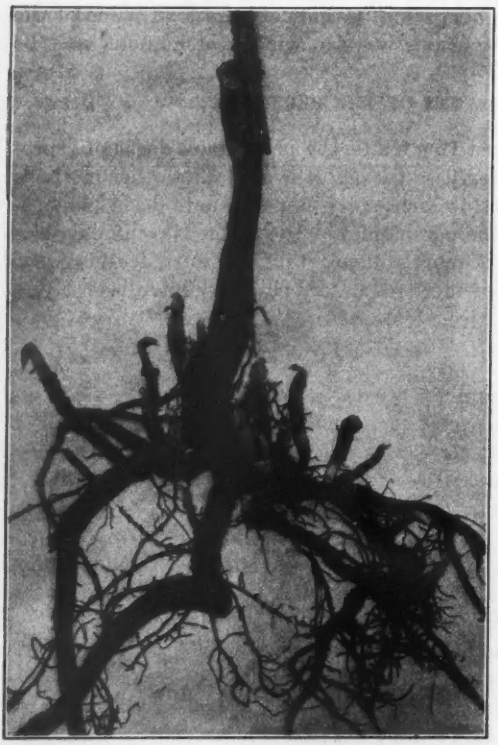

FIG. 5.—A 2-year-old seedling persimmon tree which has been grafted. It has been in a propagating bed in a greenhouse under artificial heat for two months. The sprouts on the roots show how easily the roots may be used as a means of propagating the variety.

Roots the size of a lead pencil or larger can be used in propagating the persimmon. They should be cut into pieces 6 or 8 inches long, the ends sealed with grafting wax, hot beeswax, or pitch, in order to prevent the decay that develops rapidly in the soft, spongy wood, and the cuttings should then be buried over winter in sand or in a nursery row. They will grow readily the following spring, provided the moisture supply is plentiful until they become well established.

WOOD CUTTINGS.

Cuttings of the branches may be treated in much the same way as root cuttings. Small twigs are unsuitable for purposes of propaga-

tion (1) because they lack sufficient substance to produce the callus and root formation and (2) because it is extremely difficult to prevent the organisms of decay from entering the soft, porous, 1-year-old wood. The cuttings should be waxed or pitched at both ends and buried until well callused and the roots have started. They may then be planted in a nursery row and vegetative growth encouraged.

Wood 2 or 3 years old may be selected for cuttings, but care must be exercised to procure good, strong buds. The cuttings may be taken at any time after the trees become dormant in the fall and may be placed in cold storage or in sand until wanted. It is most important, however, that the ends of the cuttings should be dipped immediately into melted wax in order to exclude the air. If they have been exposed for even a few hours they should be retrimmed and waxed before being put in cold storage or sand.

GRAFTAGE.

Those who have trees bearing exceptionally fine persimmons will find the different methods of grafting admirally adapted to top-working the worthless trees about the place with the better varieties, thus changing them to useful fruitfulness.

Top-worked, or grafted, portions of old trees will bear two or three years earlier than trees which come from buds or grafts on 1 or 2 year old stocks. These seedling stocks, budded or grafted with a selected variety, will bear one or two years earlier than those produced from cuttings.

The scions to be used in chip budding, cleft grafting, and whip grafting should be cut during late winter. All scions should be kept cool and moist until used. The budding and grafting should be done as soon as the trees which are to be grafted start to grow.

Because of the similarity in the operations of budding and grafting they are here treated together under the general heading of graftage. The various methods which have been found to be best adapted to the persimmon are here discussed.

SELECTION OF SCIONS AND BUD STICKS.

When selecting scions or bud sticks care must be exercised, just as when propagating by wood cuttings, to procure wood with strong, well-developed buds. On twigs of the last season's growth the best buds are generally near the base, where they are supported on more mature wood than those near the tip. In wood more than a year old, most of the buds near the tip have already produced branches, thus making this portion of the twig unsuitable for use in budding or grafting.

The method employed in budding persimmons largely determines the character of the wood that should be selected as a source of buds.

For the common shield or T bud, the basal half of the new growth is preferable because the bark is thinner than that on older wood and the buds fit closer and better than where wood with older and thicker bark is used. Moreover, the buds near the base of the new wood are better than those toward the tip, because the latter are so irregular in outline that it is difficult to fit them closely to the stock.

When the chip-bud method is used it is essential that the bud stick have sufficient body to allow the removal of the bud with a clean, solid chip adhering thereto. A bud stick should never be larger than the stock on which the buds are to be worked. If it is too large in relation to the size of the stock which is to receive the bud, the chip will be so broad and flat that it can not be properly fitted into any notch which it is possible to make in the stock.

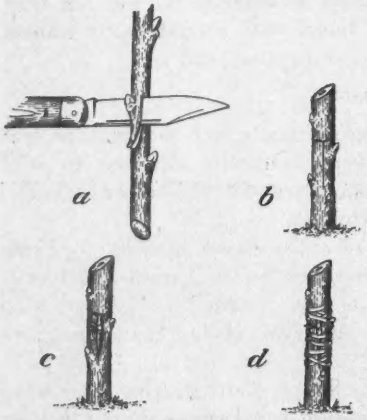

FIG. 6.—The different steps in shield or T budding: *a*, Cutting the bud; *b*, preparing the stock; *c*, inserting the bud; *d*, tying.

For annular or patch budding, the most satisfactory buds are those taken from wood that is 2, 3, or even 4 years old. Such buds are but lightly attached to the wood and have a good body of bark, which makes them easy to handle and not liable to dry out. Buds taken from near the base of large, vigorous, new shoots will also give good results.

The various methods of budding and grafting that have proved satisfactory in propagating the persimmon have been described in detail in publications of the Department of Agriculture relating to other fruits and to nuts. For convenience in the present connection, extracts from these publications are inserted below.

SHIELD OR "T" BUDDING.[1]

The height at which buds are inserted [where small seedling stocks are used] varies with the operator. In general, the nearer the ground the better. The cut for the reception of the bud is made in the shape of a letter T. (Fig. 6, *b*.) Usually the crosscut is not quite at right angles with the body of the tree, and the stem to the T starts at the crosscut and extends toward the root for an inch or more. The flaps of bark caused by the intersection of the two cuts are slightly loosened with the ivory heel of the budding knife, and the bud, grasped by the leaf stem as a handle, is placed under the flaps and firmly pushed in place until its cut surface is entirely in contact with the peeled body of the stock. (Fig. 6, *c*.) A ligature is then tightly drawn about, above, and below the bud, to hold it in place until a union shall be formed.

[1] Corbett, L. C. The propagation of plants. Farmers' Bulletin 157, pp. 22-23.

(Fig. 6, *d*.) Bands of raffia about 8 or 10 inches long make a most convenient tying material. As soon as the buds have united with the stock the ligature should be cut, in order to prevent girdling the stock. This done, the operation is complete until the following spring, when all the trees in which the buds have "taken" should have the top cut off just above the bud.

Shield budding may be done at any time when the trees are in vigorous growth and when well-matured buds of the current season's growth can be obtained. This period usually extends from July to September. When budding seedlings it may sometimes be necessary to delay the operation until the latter part of the season, in order that the stock may develop to a satisfactory size; but when top-working older trees by this method well-developed buds may be handled whenever the trees are in a vigorous condition of growth. Figure 7 shows a branch of a young persimmon tree on which a shield or T bud has made considerable growth.

FIG. 7.—A shield or T bud after considerable growth has been made.

Some of the precautions which it has been found important to observe when propagating pecans are equally applicable in the propagation of persimmons. The following directions for budding pecans according to the various methods are therefore presented here.[1]

ANNULAR BUDDING.

The process [of annular budding] is also known as "ring" and "flute" budding. It is performed during the midsummer months at such time as the bark is found to slip (release) most readily. In some seasons this period may be very brief, lasting only a few days, while in other years the time during which annular budding may be successfully performed extends over a period of several months. In the latitude of southern Georgia it is not uncommon for this method to be successful from as early as May 10 until late in July or even in August.

Annular budding consists merely in transferring a ring of bark to which is attached a bud of the desired variety from a bud stick[2] to the trunk or branch of another tree in place of a similar ring of bark previously removed. Specially designed tools have been devised for the purpose of cutting the rings. Two ordinary propagating knives having single blades may be fastened together and made to answer the purpose, although they are less liable to make uniform incisions. Cut a ring of bark from the stock with one of the tools, slit it with a single-bladed knife, and lift from its bed or "matrix," as it is technically called. Discard this bark and from the bud stick

[1] Reed, C. A. The pecan. Bureau of Plant Industry Bulletin 251, pp. 25-31.

[2] The bud stick is a branch cut from a tree of the variety to be propagated.

remove a similar ring, in the center of which is a dormant bud. The bark of the bud stick should be slit on the side opposite the bud. Immediately place this ring in the space left by removing the bark from the stock and wrap at once with waxed cloth, taking care not to cover the bud (fig. 8).

PATCH BUDDING.

When the annular method is used it is obvious that the stock and scion must be of nearly the same size. If the bud stick is slightly larger than the stock a portion of the bark to which the bud is attached may be cut away so that the two ends of the ring just meet around the stock. If the bud stick should be smaller than the stock, a strip of bark on the latter may be left in position to complete the ring. In actual practice, rings which extend only partly around the stock are most commonly used. Such process, however, is not true annular budding, because any bark which extends only partly around the stock is merely a patch. It is to this deviation from the annular method of budding that the term "patch budding" has been applied. A tool specially designed for patch budding consists of four thin steel blades fastened together in the form of a rectangle, five-eighths of an inch wide by 1 inch long, and is used as a punch.

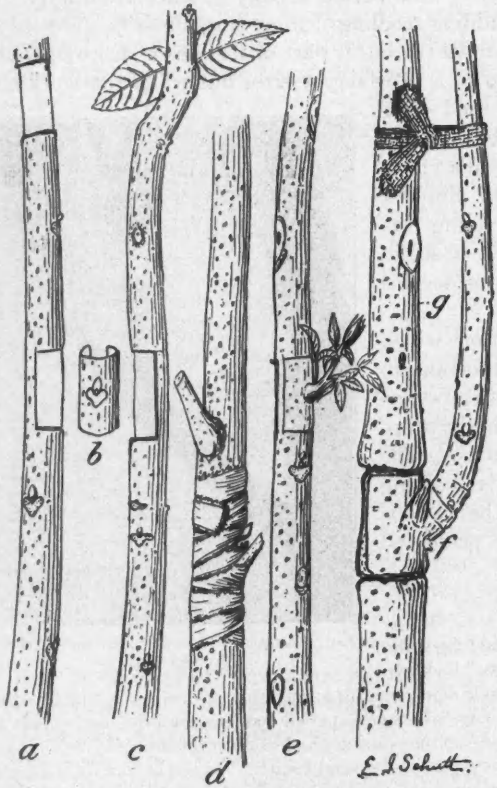

FIG. 8.—Annular budding. *a*, Bud stick from which the bud has been removed; *b*, the bud ready for insertion in the matrix of the stock; *c*, the stock ready to receive the bud; *d*, the bud after being placed in position and carefully wrapped; *e*, growth taking place, the wrapping having been removed; *f*, growth from the bud supported by being tied to the stock (*g*) above the union. Note the scars above the union, where the buds were removed in order to direct the flow of sap to the new bud.

A cut is made in the bark of the bud stick about half an inch in width by three times as long, in the center of which is the bud. The piece of bark so outlined is removed from the bud stick and laid over that of the stock. Using this as a pattern, incisions are then made around it in the bark of the stock. The pattern is then removed, the section of bark outlined in the stock is lifted, and the bark from the bud stick is put in its place. Some varieties of the pecan are more difficult to bud successfully than others; with such varieties the annular method, or a near approach to it, is generally most successful.

With the average sorts, however, the tendency among the more experienced nurserymen is much inclined to favor the patch method.

The buds best suited to annular or patch budding are those in the axils of the leaves at the base of the current season's growth. It is well worth the time required to clip the leaves away, close to the buds, 10 days or 2 weeks before the bud is wanted, for by so doing the wound will heal over before the bud is needed; otherwise a serious lessening of the vigor of the bud through evaporation may take place.

CARE OF ANNULAR AND PATCH BUDS.

In annular budding the added ring of bark sometimes unites with the stock promptly, permitting the upward flow of sap to proceed without much interference. When this is the case the top should be carefully pruned back to such a degree as is necessary to direct sufficient sap into the new bud to cause it to swell. This pruning should not be done with too great severity, as an oversupply of sap is liable to accumulate under the bark of the new bud and cause it to decay, or, as it is termed, "to drown" the bud. If the tree is young and the growth has been rapid, precaution should be exercised in cutting back the top, in order not to expose the tender bark to the heat of the sun. A sufficient amount of foliage should be left as a protection from the hot sun. If the supply of sap be limited, it will be well to cut out all buds in the top of the stock, as shown in figure 8. All dormant buds, both above and below the new bud, should be rubbed off as soon as they begin to swell. The wrapping about the new bud must be cut as soon as growth begins. As the union of a bud with a stock made by any method of budding is at first merely the uniting together of bark and not of wood, it is necessarily weak during the first few months. To avoid danger of breaking out at the bud, the new tops should be provided with extra support. For this purpose side stakes driven into the ground are sometimes used, but these are expensive and unnecessary. By leaving a stub of the original top 8 or 10 inches long, entirely denuded of foliage (fig. 8), the new top may be quickly tied to it, and when no longer needed the dead stub may be cut away close to the union.

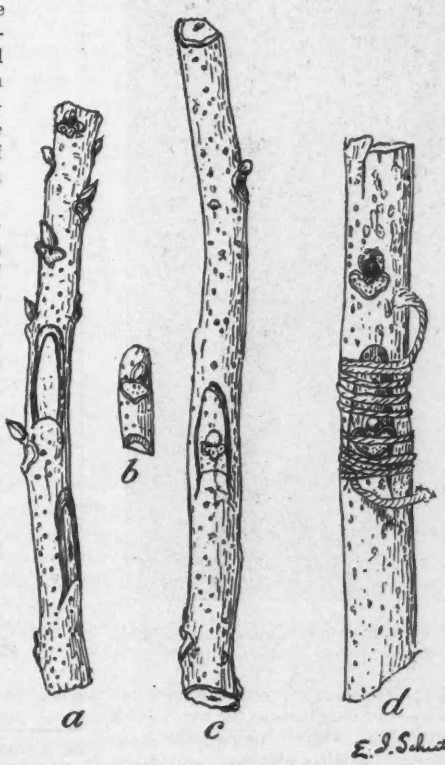

FIG. 9.—Chip or "dormant" budding. *a*, The bud stick; *b*, the bud ready for insertion; *c*, the bud inserted in the matrix of the stock; *d*, the bud securely tied in place.

CHIP BUDDING.

Propagation by chip budding is performed in the early spring or late in the dormant period. Because of being done at this season it is also known as "dormant" budding.

With a sharp knife a downward cut is made below the bud on the bud stick to a depth of perhaps one-eighth of an inch. Raising the knife to a point above the bud, a long downward cut is made, which meets the lower end of the first cut, and the bud is removed with a chip attached, as shown in figure 9. A similar chip is removed from the stock, and the desired bud is put in its place. This should be carefully wrapped with such material as will hold the cambium layers of the stock and the bud firmly together on at least one side.

Subsequent treatment similar to that already described for annular and patch budding should be given young trees propagated in this summer.

Trees of the pecan species are difficult to propagate asexually; that is, neither buds nor scions "take" with the readiness of ordinary fruit trees. The inexperienced

FIG. 10.—A chip bud on a branch after the bud inserted had made considerable growth.

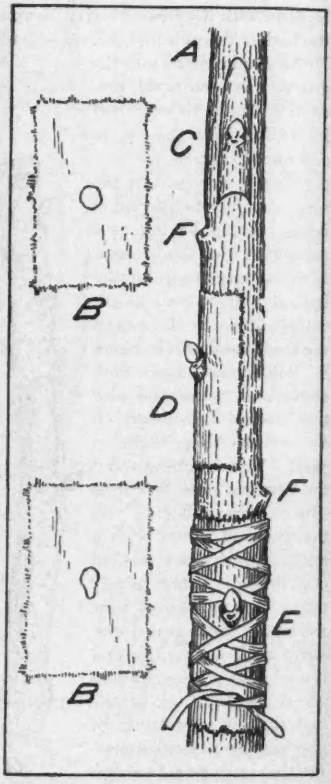

FIG. 11.—Method of using a bud protector on a chip bud. The protector may be used in a similar manner in all of the different forms of budding. *A*, stock; *B*, *B*, waxed cloth protectors; *C*, chip bud fitted into notch in stock; *D*, protector in position over the bud; *E*, protector and bud wrapped and tied; *F*, *F*, scars of buds removed from stock. (Adapted from drawing in American Fruit and Nut Journal, vol. 6, whole no. 94, p. 23.)

operator, therefore, must expect a very low percentage of living buds as the result of his first attempts. Skilled propagators, however, are now so successful that under favorable conditions the percentage of failures is no longer a matter of consequence.

No attempt to bud pecans should be made on rainy days, or in early mornings following heavy dews. Some nurserymen even go so far as to select their men for budding the pecan, assigning those who perspire most freely to other duties. Extremely hot days should be avoided, especially if accompanied by drying winds. Moderately cool, cloudy days without wind or rain are the best for pecan budding.

Figure 10 shows a persimmon chip bud which has made considerable growth.

PROTECTION OF BUDS.

A very satisfactory means of affording protection to buds inserted by any of the foregoing methods is shown in figure 11. These waxed shields are intended as a substitute for the waxed strips previously mentioned, and their preparation and use has been described as follows:[1]

In making the waxed wrappers, old domestic from worn bed sheets or undergarments may be used. Tear it into strips 2 feet long and 6 inches wide; then fold it into squares and dip it into a tin plate of hot, melted beeswax. The wax will strike through instantly, and then the strips may be held up by one end and the surplus wax allowed to drip back into the tin plate. When cool, the cloth may be torn into * * * squares of proper size. No pressing or squeezing is necessary. The beeswax answers the purpose in every way; its saves the buds, and that is the end in view. These

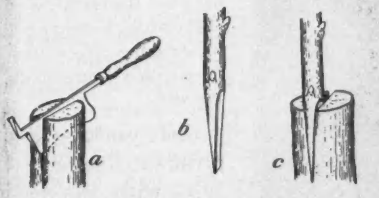

FIG. 12.—Cleft graft: *a*, Stock being split by special grafting tool; *b*, scion ready for insertion; *c*, scion in place ready for waxing.

wrappers may be left on the buds the whole season. When the bud shoots are an inch or so in length, the strings may be unwound from so much of the wrappers as cover the buds; but tie the upper end of the wrapper, which is above the bud, firmly to the projecting stub. The eyelets[2] in the wrappers will open as the bud shoots grow, and protection will be afforded against hot suns and chilly nights.

CLEFT GRAFTING.[3]

FIG. 13.—A cleft graft made on a small branch.

This style of graft is particularly adapted to large trees when for any reason it becomes necessary to change the variety. Branches too large to be worked by other methods can be cleft-grafted.

A branch 1 or 1½ inches in diameter is severed with a saw. Care should be taken that the bark be not loosened from any portion of the stub. Split the exposed end with a broad, thin chisel or grafting tool (fig. 12, *a*). Then with a wedge or the wedge-shaped prong at the end of the grafting tool spread the cleft so that the scions (fig. 12, *b*) may be inserted (fig. 12, *c*).

---

[1] American Fruit and Nut Journal, v. 6, no. 94, p. 22.

[2] The eyelet referred to is the small hole in the center of the protector shown in figure 11.

[3] Corbett, L. C. The propagation of plants. Farmer's Bulletin 157, pp. 17-18.

The scion should consist of a portion of the previous season's growth and should be long enough to have two or three buds. The lower end of the scion, which is to be inserted in the cleft, should be cut into the shape of a wedge, having the outer edge thicker than the other. In general, it is a good plan to cut the scion so that the lowest bud will come just at the top of this wedge, so that it will be near the top of the stock. The importance of having an intimate connection between the growing tissues of both scion and stock can not be too strongly emphasized, for upon this alone the success of grafting depends. To make this contact of the growing portions doubly certain, the scion is often set at a slight angle with the stock into which it is inserted, in order to cause the growing portions of the two to cross.

Fig. 14.—A cleft graft made at the crown, the soil which normally covered the union having been removed in order to show the parts to better advantage.

After the scions have been set the operation of cleft grafting is completed by covering all cut surfaces with a layer of grafting wax.

Cleft grafting has given satisfactory results with the persimmon, both on the branches (fig. 13) and at the crown (fig. 14).

WHIP GRAFTING.[1]

Whip grafting is the style almost universally used in root grafting. It has the advantage of being well adapted to small plants.

The graft is made by cutting the stock off diagonally—one long smooth cut with a sharp knife, as shown in figure 15, *c*. Place the knife about one-third of the distance from the end of the cut surface, at right angles to the cut, and split the stock in the direction of its long axis. Cut the lower end of the scion in like manner (fig. 15, *b*), and when the two parts are forced together, as shown in figure 15, *c*, the cut surfaces will fit neatly together, and one will nearly cover the other if the scion and stock are of

[1] Corbett, L. C. The propagation of plants. Farmers' Bulletin 157, pp. 18–19.

the same size. A difference in diameter of the two parts to be united may be disregarded unless it be too great. After the scion and stock have been locked together, as shown in figure 15, *c*, they should be wrapped with five or six turns of waxed cotton to hold the parts firmly together.

While top grafting may be done in this way (fig. 16), it is in root grafting that the whip graft finds its distinctive field. When the roots are cut into lengths of 2 to 5 or 6 inches to be used as stocks, the operation is known as piece-root grafting. Sometimes the entire root is used.

In ordinary propagation by means of whip grafts, the scion is cut with about three buds, and the stock is nearly as long as the scion. The graft is so planted as to bring the union of stock and scion not very far below the surface of the ground.

CARE OF WHIP GRAFTS.[1]

When grafted by the whip-graft method the young trees will require little subsequent attention other than pruning and ordinary cultivation. When the root is that of a very young tree there will be no danger of the supply of plant food being such as to induce a growth of top that is too rapid, as is frequently the case with cleft grafts, especially in the tops of old trees. While temporary staking as a support to the union is not necessary, in numerous cases stakes will be highly essential to insure erect growth. The moisture of the ground causes the wrapping material to decay in the course of a few weeks, and it is therefore not necessary to cut the bands.

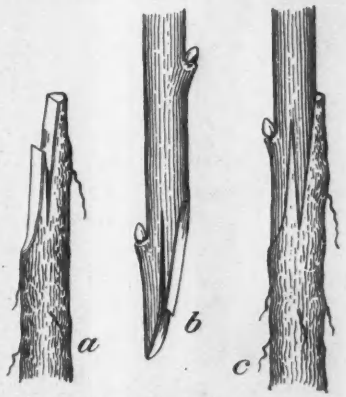

FIG. 15.—Whip graft: *a*, Stock prepared; *b*, scion prepared; *c*, stock and scion fitted together ready for tying.

The operation of grafting most fruits is generally successful if performed in the spring when the trees are still dormant, or even after growth has started slightly, provided the scions are entirely dormant. In the case of the persimmon, however, much more satisfactory results appear to be obtained when the grafting is delayed until the trees have definitely started into new growth. The scions must be kept dormant.

In all of the various methods of budding and grafting the persimmon it is of the utmost importance that the cut surfaces of both bark and wood be protected with as little delay as possible from chemical change due to exposure to the air. Protection is afforded by covering the wounds with grafting wax, waxed cloth, or similar devices.

STOCKS AND NURSERY TREES.

The stocks in the nursery row should stand at least 6 inches apart, to afford space for root development and to give the workmen plenty of room when the trees are budded or grafted. The young trees

[1] Reed, C. A. The pecan. Bureau of Plant Industry Bulletin 251, p. 25.

in the nursery should receive fair cultivation, and the roots should be pruned each year with a tree digger or spade in order to keep the root system small enough to be handled with ease when the trees are dug. The 2-year-old roots are always preferable for stocks. Older roots which are small enough to be easily handled are likely to be stunted, and 1-year-old roots must be very thrifty to produce the desired growth in the graft.

FIG. 16.—A whip graft after attaining considerable growth.

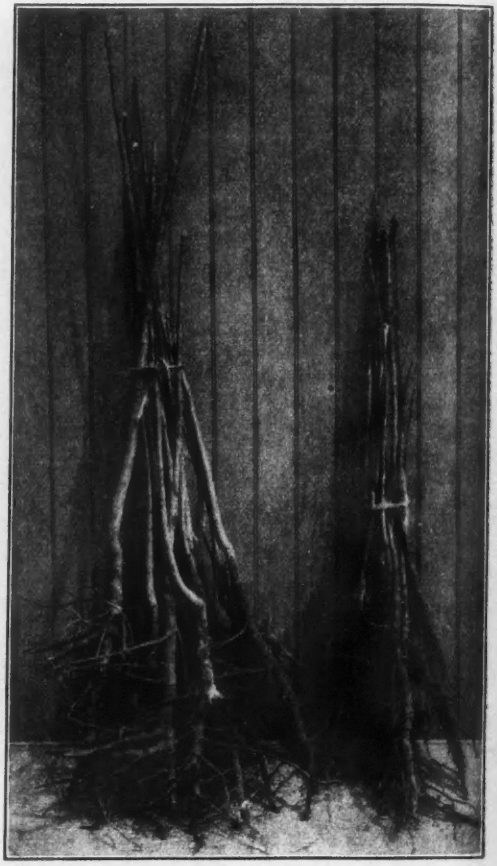

FIG. 17.—Persimmon trees after making one season's growth in the nursery. These trees were propagated by grafting on seedling stocks. The bundle on the left is the Golden Gem variety; on the right, the Miller. The largest trees are 4 to 5 feet tall. The difference in the size of the trees in the two bundles is due to the difference in the natural vigor of growth of these two sorts.

Trees which have been produced under conditions favorable for development may be planted in their permanent location after they have made one season's growth in the nursery. Some varieties, however, are much more vigorous than others. It may be advisable to grow the weaker sorts in the nursery for two years

before transplanting them. Figure 17 shows two varieties of grafted persimmon trees that have made one season's growth in the nursery.

On account of the very long taproot which persimmon trees habitually develop, particularly when propagated on seedling stocks, much care must be exercised to avoid undue injury to the root systems when the trees are dug from the nursery. Moreover, because of the deep-rooting habits of these trees a deep soil should be selected for their permanent location.

CULTIVATION OF THE PERSIMMON.

PLANTING.

The transplanting of the young trees may be done at any time during the dormant period, from late autumn to early spring, when the roots can be protected from freezing temperatures and evaporation and when the soil is in a suitable condition for handling. If the trees have been properly taken up without undue injury to the roots, the tops will need little or no pruning. If, on the other hand, the root systems have been severely reduced, the tops should be headed back until the total length of branches and trunks corresponds in a general way to the total length of the main roots. Wounds on both tops and roots should be waxed as soon as made.

Young persimmon trees have large, deep root systems and should be planted 2 or 3 inches deeper in the orchard than they were in the nursery row. In setting them out the soil should be packed thoroughly around the roots. A round-pointed wooden tamp is a very serviceable tool with which to make the earth compact as the hole is filled up. The planting plan varies with the type of tree desired. If it seems desirable to grow low-headed trees with the expectation of producing large fruit that can be readily picked by hand, the permanent trees should be placed at least 16 or, better still, 20 feet apart each way. If, however, a large bulk of fruit is desired as stock feed to be scraped from the ground or picked up by animals, a fair degree of success may be expected if the trees are planted 10 feet apart each way.

TILLAGE.

Probably the persimmon can be more successfully intercropped than any other fruit tree, owing to the depth of its root system. Blackberries, dewberries, strawberries, and vegetables thrive very well among persimmons until the shade becomes too dense. When the trees shade the ground, it is best to seed down the orchard if it is to be used as a run for chickens, calves, pigs, or other animals and the fruit used as stock feed. If it is planned to produce fruit for market purposes, however, the same cultivation should be given the ground as in a commercial orchard of peach or other fruit trees.

PRUNING.

The pruning of the persimmon varies with the variety. There is a tendency for the tree to prune itself, as many of the fruit-bearing twigs die and drop off with their fruit, thus making the natural open growth of the trees still more open and reducing to a minimum the necessity for pruning. There are two points, however, which should be borne in mind: (1) The upright tendency of some of the most vigorous varieties should be checked by pinching off the tender growing tips as they get out of reach, and (2) those trees that do not prune themselves sufficiently to keep the top well open should be thinned by removing entire limbs either main or secondary. This practice is preferable to opening the tops by thinning out the small branches and thus leaving the larger limbs bare for a considerable portion of their length. Thinning admits light and air, and at the same time a stronger vegetative growth is induced; the result is that the size of the fruit is kept uniform and the crops are made more regular by reducing the tendency to overbear on alternate years.

All wounds should be painted or otherwise covered as soon as made, in order to prevent the wood from drying or dying back and decay from entering the body of the trees.

DISEASES AND INSECT PESTS.

The persimmon is exceptionally free from the attacks of diseases and insect pests. Probably the most important of the insect enemies of the persimmon is the hickory twig girdler. The following brief account of the life history and habits of this insect, prepared for this bulletin by the Bureau of Entomology, may be of interest to those who anticipate growing the persimmon:

The hickory twig girdler, *Oncideres cingulata* Say, makes its appearance about the middle of August and may be found until the first of October. It begins depositing its eggs about the latter part of August and continues the process well into October. The eggs hatch in from seven to nine days after deposition, and the young larva begins to feed on the inner bark and wood at the point where the egg was inserted beneath the bark. As the larva increases in size it continues to feed on the wood, going deeper into the twig, and by the time its full growth has been attained it often completely hollows out the twig for some little distance from the point where it began work. Some of the larvæ attain their full growth and begin transformation to pupæ about the first of August. Others do not make this change until near the middle of September. The pupal stage lasts from 10 to 14 days, when the insects transform to adults and emerge from the twigs where they have spent their lives. Several days pass before they begin laying their eggs in the small limbs and twigs.

The injury caused by this insect occurs in the process of oviposition. The adult gnaws a small hole in the bark, usually just above or just below a bud, and the egg is inserted beneath the bark by means of the ovipositor. Several eggs are usually deposited in a twig in this manner, and the insect then begins girdling the twig beneath the point of oviposition by gnawing out small pieces of the bark. A ring is thus made around the twig, perhaps a third of the way through, weakening it to such an extent that it is broken off by the wind during the winter or the following spring. The trees are often severely injured by having the young growth pruned off in this manner.

In order to control this insect the twigs should be picked up from the ground in June or early July. All twigs which are found at this time have been girdled and broken from the tree and should be collected and burned in order to destroy the insects which are inside them.

USES OF THE PERSIMMON TREE.

The largest purchases of persimmon wood are made by the manufacturers of cotton-mill supplies, who use the timber in making bobbins. The wood is well suited for this work, as it is strong, comparatively light, hard, elastic, and close grained, taking a high polish. Shoe lasts are also made to some extent from persimmon wood.

The tree has some value for shade and ornamental purposes. Concerning this use of the native persimmon Mr. F. L. Mulford, landscape gardener of the Department of Agriculture, writes as follows:

As an ornamental for lawns the persimmon compares favorably with any of the shade trees used on private grounds, provided that it does not overhang a sidewalk, where the dropping of fruits would be objectionable. The broad, glossy leaves on the gracefully drooping branches give a dense shade from early in the spring until the autumn is well advanced.

In the early summer the little waxlike flowers fill the air with a delicious fragrance, somewhat resembling that of the calla lily. When the fruit begins to mature, yellowish and golden clusters appear among the dark-green leaves and add to the beauty of the tree until they fall. Some of the later varieties are ornamental after the leaves have fallen and even until well into the winter.

USES OF THE PERSIMMON FRUIT.

The only fruit which equals the persimmon in food value is the date. This is shown by the analyses presented in Table I.

TABLE I.—*Comparative analyses of fresh fruits, showing their food values in percentages of the weight of the fruit.*[1]

Fruit.	Total solids.	Ash.	Protein.	Sugars.	Crude fiber.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Apples	13.65	0.28	0.69	10.26	0.96
Blackberries	13.59	.48	.51	4.44	5.21
Cherries	22.30	.65	.81	11.72	.62
Currants	15.23	.72	.51	6.38	4.57
Dates	[2][3] 66.86	[4] 1.20	[5] 1.48	[6] 56.59	[7] 3.80
Figs	20.13	.57	1.34	15.51	.....
Grapes[8]	[2] 21.83	.53	.59	[9] 17.11	3.60
Oranges (Navel)	13.87	.43	.48	15.91	.....
Peaches[7]	[2] 10.60	.40	.70	[6] 5.90	3.60
Pears	16.97	.31	.36	8.26	4.30
Persimmons[10]	[2] 35.17	.78	.88	[9] 31.74	1.43
Plums	15.14	.61	.40	3.56	4.34
Raspberries	13.79	.49	.53	3.95	5.90
Strawberries	9.48	.60	.97	5.36	1.51

[1] Data, with exceptions as noted, from Bureau of Chemistry Bulletin 66, pp. 41–42.
[2] Dry matter.
[3] Average of 11 analyses. See "Chemistry and ripening of the date," Arizona Agricultural Experiment Station Bulletin 66, p. 408.
[4] See "Principles of nutrition and nutritive value of food," Farmers' Bulletin 142, p. 18.
[5] Adapted from the two publications mentioned in footnotes 3 and 4.
[6] Fats and carbohydrates.
[7] See "Use of fruit as food," Farmers' Bulletin 293, p. 14.
[8] See "The American persimmon," Indiana Experiment Station Bulletin 60 (1896), p. 52.
[9] Nitrogen-free extract.
[10] Average of 6 analyses in "The American persimmon," Indiana Experiment Station Bulletin 60 (1896).

Probably the most common use of the fruit is as feed for hogs. As a rule, the hogs are merely turned loose in lots where persimmon trees have come up naturally. Some, however, who appreciate the value of this fruit as stock feed have set out orchards in order to provide a definite supply for this purpose. If varieties are selected which ripen in a continuous sequence, the fruit will, in some sections, furnish forage for hogs from the last of August until early winter. A small area devoted to persimmons can thus be made a valuable asset for any general farm located in a persimmon district which includes hogs among its stock.

The persimmon fruits intended for shipment should, to avoid bruising, be carefully hand picked while still quite firm, that is, just as the flesh begins to soften. Fruits which can be delivered direct to the consumer should not be picked until fully mature and should also be handled with great care. Fruit of the later varieties, especially those of the oblong type, often hang on the trees for weeks, drying to about the consistency of the commercial date.

Quart and pint size berry boxes are commonly used when packing the fruit for market, the baskets being handled in the ordinary strawberry crates. Larger units would result in bruising the softer fruits and are therefore not advisable. Crates in which the individual fruits are placed in separate compartments are suggested for shipping the better grades of persimmons, and it is believed that a trade which will fully repay the expense and trouble of this method of handling can be built up in any town of moderate size. Persimmons which are placed in storage should be packed in egg crates or similar containers that hold the fruits separate.

RECIPES FOR USING PERSIMMONS.

Before the advent of the white man, the Indians mixed the pulp of this fruit with crushed corn and made it into a kind of bread. Now, there are many ways in which the fruit can be used, but the different methods are not well known, and many people with fine trees in their possession are allowing the fruit to waste because they do not realize its value. The dissemination of knowledge regarding the use of the persimmon in preparing very palatable food products should result in much wider use of the fruit. To this end a number of recipes are included in this publication.

Since heat makes the astringency of the persimmon more apparent, it is always well to add one-half teaspoonful of baking soda (bicarbonate of soda) to each cupful of persimmon pulp in all recipes where the fruit is subjected to heat. Although it has been proved by experiment that the soda may be omitted if the fruit is entirely free from astringency, it is better to use it until one is sure of the quality of the persimmon pulp.

PERSIMMON BREAD.

1 cup of persimmon pulp.
1 cup of water.
½ teaspoonful of soda.
Yeast.
Shortening.
Flour to make a stiff dough.

Set to rise, mold, and bake like other bread.

PERSIMMON CRUMPETS.

Take 1 pint of the sponge of persimmon bread which has been set over night, add 1 egg and enough milk to make a thin batter, set to rise for one hour, then bake on a hot griddle like griddlecakes. Serve hot with butter or sirup.

PERSIMMON GRIDDLECAKES.

1 cup of persimmon pulp.
1 egg.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.
Milk to make a thin batter.

Bake and serve as above.

PERSIMMON-PEANUT GRIDDLECAKES.

1 cup of persimmon pulp.
1 tablespoonful of peanut butter.
1 egg.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.
Milk to make a thin batter.

Bake and serve as above.

PERSIMMON-PEANUT MUFFINS (A GOOD RECIPE FOR CAMPERS).

½ cup of persimmon pulp.
1 tablespoonful of peanut butter.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.

Press or cut in pats ½ inch thick and bake in a quick oven.

COFFEE FRUIT CAKE.

Boil together 1 cup of molasses and 1½ cups of minced dried persimmons for five minutes. Cream 1 cup of sugar, ½ cup of butter and 1 egg, and add to the above. Stir in three-fourths of a cup of strong coffee and place on a warm stove. Add 2 cups of flour; 1½ teaspoonfuls of mixed ground spice; 1½ teaspoonfuls of a phosphate baking powder, or, if preferred, 1 teaspoonful of baking powder and ½ teaspoonful of soda.

Bake in a moderate or slow oven 40 minutes to 1 hour.

PERSIMMON CAKE.

1 cup of persimmon pulp.
½ cup of sugar.
1 egg.
Butter of size of a walnut.
1 cup of flour.
1 teaspoonful of baking powder.
½ teaspoonful of soda.

Bake 40 minutes in a moderate oven. For a soft pudding leave out the eggs. For a custard leave out the flour and the baking powder.

PERSIMMON PUDDING (CAKE OR PONE).[1]

1 pint of fine persimmon pulp.
1 cup of sugar.
1 quart of sweet milk.
3 cups of flour.
1 teaspoonful of ground cinnamon.
2 teaspoonfuls of baking powder.

PRESERVED PERSIMMON PULP.

Place equal amounts of persimmon pulp and sugar in glass or earthenware jars or in coated sanitary cans. (Never use cans of uncoated tin for persimmons.) Mix thoroughly and set in a cool, light place. Stir occasionally until the air is removed and seal with paraffin or waxed paper. The cans may be heated over a slow fire, just enough to drive out the air, and should be sealed at once.

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[1] The American persimmon. Indiana Experiment Station Bulletin 60, pp. 43–54, 1896.

PRESERVED WHOLE PERSIMMONS.

Put a thin layer of sugar in the bottom of a jar; then a layer of whole ripe persimmons, then a layer of sugar; and so on until the jar is full. The sugar will soon dissolve and form a sirup. Press the upper fruits down under the sirup or add more sirup to the jars. Seal and store until used. The sirup may be drained off and the fruits served like dates, which they will resemble in appearance and flavor.

PERSIMMON LEATHER.

Spread a thin layer of ripe persimmon pulp on waxed paper or on a large platter. Dry in the sun, in a fruit evaporator, or in the oven of a stove, leaving the oven doors open. Remove the seeds. Add another layer of pulp, and repeat until the leather is of a thickness to handle easily. This may be diced or minced and used instead of raisins or citron in fruit cakes, cookies, or puddings.

PERSIMMON ICE CREAM.

2 cups of persimmon pulp. 1 cup of thick, sweet cream.

Beat together thoroughly and freeze like ordinary ice cream. The fruit must be thoroughly ripe and nonastringent.

PERSIMMON FRUIT ICE.

2 cups of persimmon pulp. 1 cup of sugar.

Beat to a creamy pulp and freeze.

PERSIMMON TAFFY.

Two cups of the sirup from the preserved whole persimmons. Add 1 cup of sugar and cook until it forms a hard ball in water. Pour on a buttered platter and pull. Cut in sticks and squares.

PERSIMMON FUDGE.

2 cups of persimmon pulp. 2 cups of sugar.

Cook over a slow fire, stirring occasionally, until graining begins. Add 1 teaspoonful of baking soda and stir over the fire until quite stiff. Spread on buttered platter or paraffin paper.

VARIETIES.

The native varieties of persimmons that have been named and propagated have originated with few, if any exceptions, as selections from the wild, of superior individual trees. Their superiority has usually been in size, appearance, flavor, proportion of flesh to seeds, or in some other fruit character. Productiveness of trees may have been a correlated factor in some instances.

In the original issue of this bulletin in 1915, 13 named varieties were briefly characterized. Trees of these varieties were then available, or had recently been, through the nurseries. Not more than 2 or 3 of them are now listed, so far as known, by any nursery. Meanwhile a half-dozen or so other varieties have been named and catalogued but in most instances only a single nursery is propagating any one of these newer sorts. Judging from the past the most of these are likely to drop out of sight within a few years unless there should be an increase in interest in native persimmons such as to justify nurserymen in giving more attention to the propagation of the trees.

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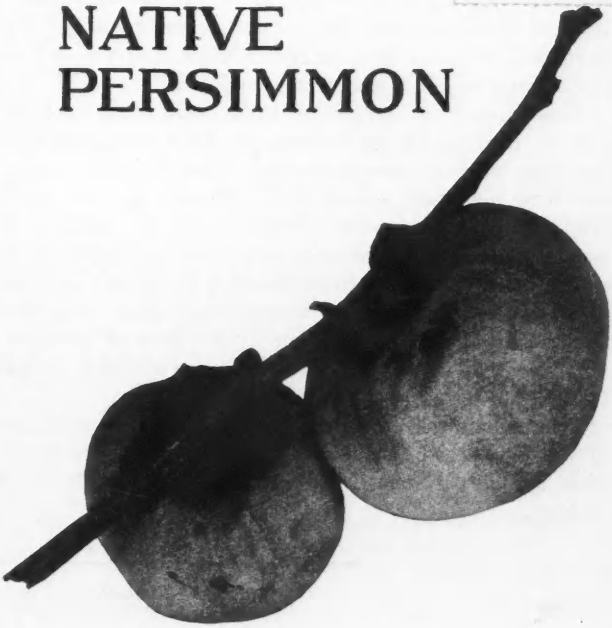
THE NATIVE PERSIMMON



THE NATIVE PERSIMMON is considerably prized by many who are familiar with it in its natural range of distribution and who have opportunities to eat the fruit at its best; it is considerably derided and scorned by many who think only of its extreme astringency when eaten before it is fully mature and in "good eating condition."

As is the case with some other native fruits, little has been done to improve the persimmon. A number of selections have been made of trees producing superior fruit in the wild, and these have been named and propagated for the trade. During the second decade of this century the number of such varieties probably reached its maximum. In the more recent years, apparently from lack of demand for the trees, most nurseries have ceased to propagate them, with the result that at the present time (1935) trees of probably not more than 2 or 3 named varieties are available to the trade.

This bulletin sets forth methods of propagation and care of the trees, calls attention to some of the merits of the fruit, and, in particular, supplies some recipes for its use in cookery.

Washington, D. C.

Issued October 1915
Revised August 1935

THE NATIVE PERSIMMON

By W. F. FLETCHER, formerly *scientific assistant, Division of Pomology and Horticulture, Bureau of Plant Industry*

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INTRODUCTION

THE PERSIMMON seems to have been the first native American fruit to be described and praised by the early explorers. De Soto learned its food value in 1539, and in 1557 published an account of it at Evora, Portugal. The following year, 1558, Jan de Laet described the persimmon in his work on Virginia. John Smith's narrative of the settlements and resources of the New World, written during the first years of the seventeenth century, included a long discussion of the persimmon. In his reference to this fruit, where he says "If it be not ripe, it will draw a man's mouth awrie with much torment", he so well characterizes the puckering, astringent effect of the tannin contained in the immature fruit that no other comment is necessary.

The persimmon tree has received more criticism, both adverse and favorable, than almost any other known species. Those who have discussed the food value of the fruit, from the earliest chroniclers to recent writers, have prophesied that the tree would soon be accorded a place in our gardens and orchards. Those people, on the other hand, who have been acquainted only with the immature fruit or with the young sprouts in cultivated fields have had nothing to say in its favor and have bent their energies toward its destruction rather than its propagation and cultivation.

There are several factors which are responsible for the slow progress of persimmon development in this country. One reason for the neglect of this fruit seems to be the erroneous yet oft-repeated statement that persimmons are unfit to eat until they have either been touched by frost or frozen. Although this statement has been corrected by nearly every one who has studied the subject, nevertheless throughout the regions where persimmons are grown many of the

best fruits are lost each year because they ripen and fall before frost or before they are supposed to be edible. The truth of the matter is that freezing is as detrimental to the quality of persimmons as to the quality of any other fruit. If persimmons are not edible and free from astringency before frost, it is because the variety is a late one and the fruit has not yet matured.

The development of the persimmon, whether for orchard or ornamental purposes, has been retarded by the difficulty encountered in propagating and transplanting it. One grower has characterized it as the only tree that he could not kill in his cultivated fields and the only one that he could not make live in his garden. Failure in transplanting is usually due to a lack of knowledge concerning the characteristic root development of the persimmon. Under natural conditions, the roots penetrate much deeper into the soil than those of most other fruit trees, and unless great care is exercised when the tree is taken up it is almost impossible to get more than a small percentage of the root system, thus reducing the chance of making the tree live when transplanted.

From time to time valuable trees have been discovered, cared for, and even in some cases transplanted or propagated. Most of these have been soon neglected or destroyed, until there are comparatively few varieties of marked value available for general distribution.

Both De Soto and Jan de Laet when describing the ripe fruit of the native persimmon call it a "delicious little plum", and John Smith and other writers of the seventeenth century speak of it as a plum with the flavor of an apricot. This use of the word "plum" doubtless directed the attention of many people to the native species of *Prunus*, which include our wild cherries and plums.

BOTANICAL CLASSIFICATION

The persimmon belongs to the ebony family (Ebenaceæ) and is known to botanists as *Diospyros virginiana*. It is the only member of the family which is indigenous to any extensive portion of this country.

NATURAL DISTRIBUTION

Roughly speaking, the persimmon is indigenous to the southeastern quarter of the United States, being found in large numbers in the fields and forests of that region. The more favored localities in Iowa and eastern Nebraska produce many fruits, but very few trees are found west of central Kansas. Scattering specimens in Connecticut and on Long Island mark the present northeastern limit of the species. A few trees in Rhode Island, New York, and Michigan which produce fairly well indicate that the northern limit of cultivation may be extended whenever economic conditions (that is, the value of the fruit for food or of the tree for ornamental purposes) seem to warrant.

The zone of greatest productivity and adaptability, wherein appear by far the largest number of promising types, extends from Maryland, Virginia, and the Carolinas westward through Missouri and Arkansas. The persimmon thrives equally well on the sands of the Coastal Plain, the shales of the Allegheny Mountains, the muck of the river-bottom lands, and the chert of the Ozarks.

GENERAL DESCRIPTION

HABIT OF GROWTH

Throughout the habitat of the persimmon there is a wide variation in the size and growth of the trees and in the form, size, color, and number of seeds of the fruit. The tree characters seem to indicate two types, upright and drooping, and these tree types are closely allied with the fruit types.

When grown in the open, persimmon trees rarely reach a height of 50 feet. In a dense forest growth they sometimes reach 70 or 100 feet, but that is uncommon. The characteristic checking of the bark of an old tree, which is shown in figure 1, aids one to recognize the species. The top of the tree is usually roundish or conical in form. Large trees are often somewhat irregular, owing to the breaking of limbs by heavy crops of fruit; moreover, it is a characteristic of productive trees to prune themselves by dropping many of the fruit-bearing twigs. The branches are always spreading, often coming out almost at right angles to the trunk and then drooping more or less, especially after the tree has borne a few crops.

FIGURE 1.—An old persimmon tree which shows the characteristic checking of the bark.

The leaves are elliptical or slightly ovate in form, acuminate at the apex, measuring from 3 to 6 inches in length and 1 to 3 inches in width, with a short petiole. In color, they are a dark glossy green on the upper surface and a grayish green underneath. Trees differ markedly, however, in habits of growth, as is shown in figures 2, 3, and 4.

FLOWERING HABIT

The flowers resemble little lipped urns of wax, from one-fourth to three-fourths of an inch in length, the color varying from a greenish yellow to a milky white. They are borne on short stalks and appear from the last of April in the extreme South until the middle of June at the northern limit of the persimmon habitat.

The trees are generally dioecious; that is, the pollen-bearing and fruit-producing flowers are borne on separate trees. The pistillate or fruit-producing flowers are borne singly, while the staminate or pollen-bearing flowers are generally produced in threes. The pollen is very light and powdery, and while it is generally distributed by the bees that frequent the trees in great numbers during blossoming time it can also be carried to great distances by the wind.

FRUIT CHARACTERS

The fruit is a true berry containing sometimes as many as eight seeds in its pale, translucent flesh. It varies in form from oblate to oblong and in diameter from three-fourths of an inch to 2 inches. There is a wide range in color, varying from yellow to pale orange and even to a dark red, with many varietal markings, often blushed and covered with a bluish bloom. When green, persimmons are generally very astringent and puckery, because of the large quantity of tannin contained in the flesh, but when thoroughly mature and ripe the flavor is rich and sweet, and the consistency varies between that of a baked apple and a soft custard. The fruits of many late varieties turn a rich dark red and partially dry on the trees.

FIGURE 2.—A persimmon tree of the upright type which produces large, oblate fruits and is here used as a dooryard tree.

POSSIBILITIES OF IMPROVEMENT

The season of the native persimmon is probably longer than that of any other wild fruit, both locally and over the country as a whole. In many sections the earliest and the latest varieties may be found growing side by side, or at least within a few miles of each other. The Bureau of Plant Industry has records for both early and late varieties from the southern part of Georgia and Florida. In the District of Columbia there are some trees which ripen their fruit in August and others on which it hangs until February.

Generally speaking, the best fruits are neither the earliest nor the latest, but rather those that ripen just before the beginning of the tree's dormant season. The latest varieties are still immature when the leaves fall or when they are killed by frost, and they must complete the ripening process within themselves instead of drawing nourishment from the tree until they have grown to maturity.

The largest as well as the best fruits are those that ripen about the time the trees shed their leaves. The early varieties are nearly all medium in size, and the late varieties which hang on until cold weather are generally small. Seedless fruits, as a rule, are smaller and earlier than those with seeds produced on the same trees.

The wide variations shown by the fruit in size, color, season of maturity, and tendency to seedlessness, and by the trees in size, shape, and vegetative vigor indicate the possibility of greatly improving the native persimmon. Up to the present time one essential factor has been overlooked in all attempts at breeding better varieties. That factor is the parentage of the male or pollen-bearing trees. Without a knowledge of the characters represented in the male parent there is no certainty as to the results of the crossing and no possibility of the line breeding which is essential to the rapid development of improved varieties. Definite efforts should be made in breeding work to secure pollen-bearing trees of known parentage. They should be selected from among trees grown from seed produced on the most desirable fruit-bearing trees.

FIGURE 3.—A persimmon tree of upright habit of growth which produces fruit of the pyriform type, ripening in midseason.

PRESENT STATUS

Throughout the region where persimmons are found in abundance the fruit is considered as being "good for dogs, hogs, and 'possums." Occasionally a family is mentioned as having lived for several months upon the fruit from a single large tree.

In some of the large cities and towns within the persimmon habitat, the wild fruit can be purchased during the autumn and early winter from the dealers who occupy the open stalls in the public markets. A few enterprising growers adjacent to large cities have built up a demand for the fruit.

The methods of utilizing the persimmon are at present rather limited. Fresh fruit is used in various ways—in making a few kinds of pudding, sherbet, cake, etc.

PROPAGATION

As is the case with most tree fruits, the persimmon does not reproduce its varietal characteristics through the seed, and other methods of propagation are, therefore, necessary to perpetuate desirable varieties. Propagation of the persimmon by the methods commonly employed with tree fruits is more difficult than for such fruits as the apple or the peach. The methods described below have been found successful in actual practice.

SEEDING

The seeds of the persimmon are scattered by mammals and birds and in the natural sequence of events reach the ground in the fall or winter without becoming dry. They are lightly covered with grass or leaves and are subjected to the varying temperatures of winter, always remaining moist. The following spring the seeds sprout as soon as the soil becomes warm enough, provided that the conditions accompanying the rise in temperature do not dry them unduly. Seeds which fall under the trees are usually too much exposed to the atmosphere and dry too much to admit of germination.

Seeds that are gathered for propagating purposes should be stratified at once. If they are allowed to dry out it is often necessary to soak them for 2 or 3 days before they are planted, the water being renewed each day at a boiling temperature.

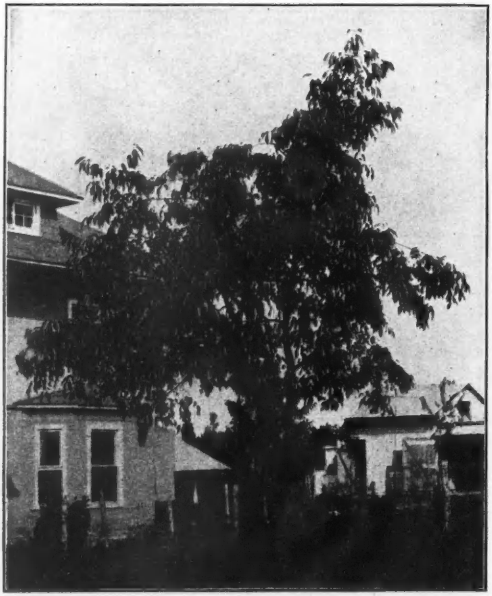

FIGURE 4.—A persimmon tree which has a drooping habit of growth and produces fruit of the oblong type.

The seed bed in which persimmon seedlings are grown should be located on well-drained land where the soil is rather light and well supplied with humus. The ground should be plowed deep with a subsoil plow unless the subsoil is friable enough to permit the ready penetration of the long taproots which characterize the growth of persimmon seedlings.

The seed may be planted either in the fall or spring, after being treated as described above. It is commonly planted in shallow drills and lightly covered with soil to a depth of one-half inch or a little more.

CUTTINGS

ROOT CUTTINGS

The roots of persimmon trees sprout readily when the top is removed or when the main stem meets with serious injury. This is illustrated in figure 5, which shows the development of sprouts on the roots of a seedling tree 2 months after the removal of the top. During this period the seedling had been in a propagating bed in a greenhouse, under artificial heat. This illustration also offers an explanation for the occurrence of the large clumps of similar trees

that are to be found in many abandoned fields. At some time the original tree was cut off near the surface of the ground and the roots sent up sprouts which, being undisturbed, developed into trees bearing similar fruit.

Roots the size of a lead pencil or larger can be used in propagating the persimmon. They should be cut into pieces 6 or 8 inches long, the ends sealed with grafting wax, hot beeswax, or pitch, in order to prevent the decay that develops rapidly in the soft, spongy wood, and the cuttings should then be buried over winter in sand or in a nursery row. They will grow readily the following spring, provided the moisture supply is plentiful until they become well established.

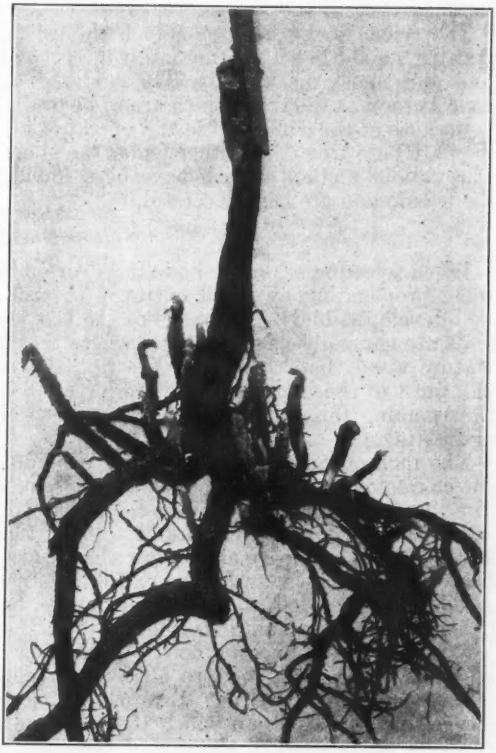

FIGURE 5.—A 2-year-old seedling persimmon tree which has been grafted. It has been in a propagating bed in a greenhouse under artificial heat for 2 months. The sprouts on the roots show how easily the roots may be used as a means of propagating the variety.

WOOD CUTTINGS

Cuttings of the branches may be treated in much the same way as root cuttings. Small twigs are unsuitable for purposes of propagation (1) because they lack sufficient substance to produce the callus and root formation and (2) because it is extremely difficult to prevent the organisms of decay from entering the soft, porous, 1-year-old wood. The cuttings should be waxed or pitched at both ends and buried until well callused and the roots have started. They may then be planted in a nursery row and vegetative growth encouraged.

Wood 2 or 3 years old may be selected for cuttings, but care must be exercised to procure good, strong buds. The cuttings may be taken at any time after the trees become dormant in the fall and may be placed in cold storage or in sand until wanted. It is most important, however, that the ends of the cuttings should be dipped immediately into melted wax in order to exclude the air. If they have been exposed for even a few hours they should be retrimmed and waxed before being put in cold storage or sand.

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GRAFTING

Those who have trees bearing exceptionally fine persimmons will find the different methods of grafting admirably adapted to top-working the worthless trees about the place with the better varieties, thus changing them to useful fruitfulness.

Top-worked, or grafted, portions of old trees will bear 2 or 3 years earlier than trees which come from buds or grafts on 1- or 2-year-old stocks. These seedling stocks, budded or grafted with a selected variety, will bear 1 or 2 years earlier than those produced from cuttings.

The scions to be used in chip budding, cleft grafting, and whip grafting should be cut during late winter. All scions should be kept cool and moist until used. The budding and grafting should be done as soon as the trees which are to be grafted start to grow.

Because of the similarity in the operations of budding and grafting they are here treated together under the general heading of grafting. The various methods which have been found to be best adapted to the persimmon are here discussed.

SELECTION OF SCIONS AND BUD STICKS

When selecting scions or bud sticks care must be exercised, just as when propagating by wood cuttings, to procure wood with strong, well-developed buds. On twigs of the last season's growth the best buds are generally near the base, where they are supported on more mature wood than those near the tip. In wood more than a year old, most of the buds near the tip have already produced branches, thus making this portion of the twig unsuitable for use in budding or grafting.

The method employed in budding persimmons largely determines the character of the wood that should be selected as a source of buds. For the common shield or T-bud, the basal half of the new growth is preferable because the bark is thinner than that on older wood and the buds fit closer and better than where wood with older and thicker bark is used. Moreover, the buds near the base of the new wood are better than those toward the tip, because the latter are so irregular in outline that it is difficult to fit them closely to the stock.

When the chip-bud method is used it is essential that the bud stick have sufficient body to allow the removal of the bud with a clean, solid chip adhering thereto. A bud stick should never be larger than the stock on which the buds are to be worked. If it is too large in relation to the size of the stock which is to receive the bud, the chip will be so broad and flat that it cannot be properly fitted into any notch which it is possible to make in the stock.

For annular or patch budding, the most satisfactory buds are those taken from wood that is 2, 3, or even 4 years old. Such buds are but lightly attached to the wood and have a good body of bark, which makes them easy to handle and not liable to dry out. Buds taken from near the base of large, vigorous, new shoots will also give good results.

The various methods of budding and grafting that have proved satisfactory in propagating the persimmon have been described in detail in publications of the Department of Agriculture relating to other fruits and to nuts. For convenience in the present connection, extracts from these publications are inserted below.

SHIELD OR "T" BUDDING [1]

The height at which buds are inserted [where small seedling stocks are used] varies with the operator. In general, the nearer the ground the better. The cut for the reception of the bud is made in the shape of a letter T (fig. 6, *b*). Usually the crosscut is not quite at right angles with the body of the tree, and the stem to the T starts at the crosscut and extends toward the root for an inch or more. The flaps of bark caused by the intersection of the two cuts are slightly loosened with the ivory heel of the budding knife, and the bud, grasped by the leaf stem as a handle, is placed under the flaps and firmly pushed in place until its cut surface is entirely in contact with the peeled body of the stock (fig. 6, *c*). A ligature is then tightly drawn about, above, and below the bud, to hold it in place until a union shall be formed (fig. 6, *d*). Bands of raffia about 8 or 10 inches long make a most convenient tying material. As soon as the buds have united with the stock the ligature should be cut, in order to prevent girdling the stock. This done, the operation is complete until the following spring, when all the trees in which the buds have "taken" should have the top cut off just above the bud.

Shield budding may be done at any time when the trees are in vigorous growth and when well-matured buds of the current season's growth can be obtained. This period usually extends from July to September. When budding seedlings it may sometimes be necessary to delay the operation until the latter part of the season, in order that the stock may develop to a satisfactory size; but when top-working older trees by this method well-developed buds may be handled whenever the trees are in a vigorous condition of growth. Figure 7 shows a branch of a young persimmon tree on which a shield or T-bud has made considerable growth.

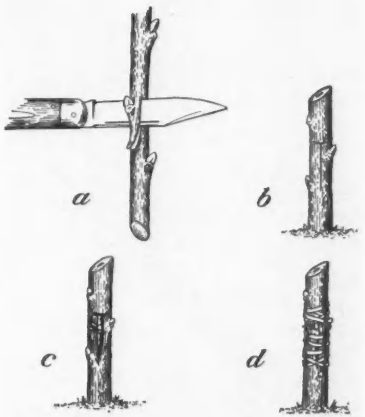

FIGURE 6.—The different steps in shield or T-budding: *a*, Cutting the bud; *b*, preparing the stock; *c*, inserting the bud; *d*, tying.

Some of the precautions which it has been found important to observe when propagating pecans are equally applicable in the propagation of persimmons. The following directions for budding pecans according to the various methods are therefore presented here.[2]

ANNULAR BUDDING

The process [of annular budding] is also known as "ring" and "flute" budding. It is performed during the midsummer months at such time as the bark is found to slip (release) most readily. In some seasons this period may be very brief, lasting only a few days, while in other years the time during which annular budding may be successfully performed extends over a period of several months. In the latitude of southern Georgia it is not uncommon for this method to be successful from as early as May 10 until late in July or even in August.

[1] From Farmers' Bulletin 157, The Propagation of Plants.
[2] From Bureau of Plant Industry Bulletin 251, The Pecan. Out of print, but may be consulted in libraries. See also Farmers' Bulletin 1501, Nut-Tree Propagation.

Annular budding consists merely in transferring a ring of bark to which is attached a bud of the desired variety from a bud stick [3] to the trunk or branch of another tree in place of a similar ring of bark previously removed. Specially designed tools have been devised for the purpose of cutting the rings. Two ordinary propagating knives having single blades may be fastened together and made to answer the purpose, although they are less liable to make uniform incisions. Cut a ring of bark from the stock with one of the tools, slit it with a single-bladed knife, and lift from its bed or "matrix", as it is technically called. Discard this bark and from the bud stick remove a similar ring, in the center of which is a dormant bud. The bark of the bud stick should be slit on the side opposite the bud. Immediately place this ring in the space left by removing the bark from the stock and wrap at once with waxed cloth, taking care not to cover the bud (fig. 8).

PATCH BUDDING

When the annular method is used it is obvious that the stock and scion must be of nearly the same size. If the bud stick is slightly larger than the stock a portion of the bark to which the bud is attached may be cut away so that the two ends of the ring just meet around the stock. If the bud stick should be smaller than the stock, a strip of bark on the latter may be left in position to complete the ring. In actual practice, rings which extend only partly around the stock are most commonly used. Such process, however, is not true annular budding, because any bark which extends only partly around the stock is merely a patch. It is to this deviation from the annular method of budding that the term "patch budding" has been applied. A tool specially designed for patch budding consists of four thin steel blades fastened together in the form of a rectangle, five-eighths of an inch wide by 1 inch long, and is used as a punch.

FIGURE 7.—A shield or T-bud after considerable growth has been made.

A cut is made in the bark of the bud stick about half an inch in width by three times as long, in the center of which is the bud. The piece of bark so outlined is removed from the bud stick and laid over that of the stock. Using this as a pattern, incisions are then made around it in the bark of the stock. The pattern is then removed, the section of bark outlined in the stock is lifted, and the bark from the bud stick is put in its place. Some varieties of the pecan are more difficult to bud successfully than others; with such varieties the annular method, or a near approach to it, is generally most successful.

With the average sorts, however, the tendency among the more experienced nurserymen is much inclined to favor the patch method.

The buds best suited to annular or patch budding are those in the axils of the leaves at the base of the current season's growth. It is well worth the time required to clip the leaves away, close to the buds, 10 days or 2 weeks before the bud is wanted, for by so doing the wound will heal over before the bud is needed; otherwise a serious lessening of the vigor of the bud through evaporation may take place.

CARE OF ANNULAR AND PATCH BUDS

In annular budding the added ring of bark sometimes unites with the stock promptly, permitting the upward flow of sap to proceed without much interference. When this is the case the top should be carefully pruned back to such a degree as is necessary to direct sufficient sap into the new bud to cause it to swell.

[3] The bud stick is a branch cut from a tree of the variety to be propagated.

This pruning should not be done with too great severity, as an oversupply of sap is liable to accumulate under the bark of the new bud and cause it to decay, or, as it is termed, "to drown" the bud. If the tree is young and the growth has been rapid, precaution should be exercised in cutting back the top, in order not to expose the tender bark to the heat of the sun. A sufficient amount of foliage should be left as a protection from the hot sun. If the supply of sap be limited, it will be well to cut out all buds in the top of the stock, as shown in figure 8. All dormant buds, both above and below the new bud, should be rubbed off as soon as they begin to swell. The wrapping about the new bud must be cut as soon as growth begins. As the union of a bud with a stock made by any method of budding is at first merely the uniting together of bark and not of wood, it is necessarily weak during the first few months. To avoid danger of breaking out at the bud, the new tops should be provided with extra support. For this purpose side stakes driven into the ground are sometimes used, but these are expensive and unnecessary. By leaving a stub of the original top 8 or 10 inches long, entirely denuded of foliage (fig. 8), the new top may be quickly tied to it, and when no longer needed the dead stub may be cut away close to the union.

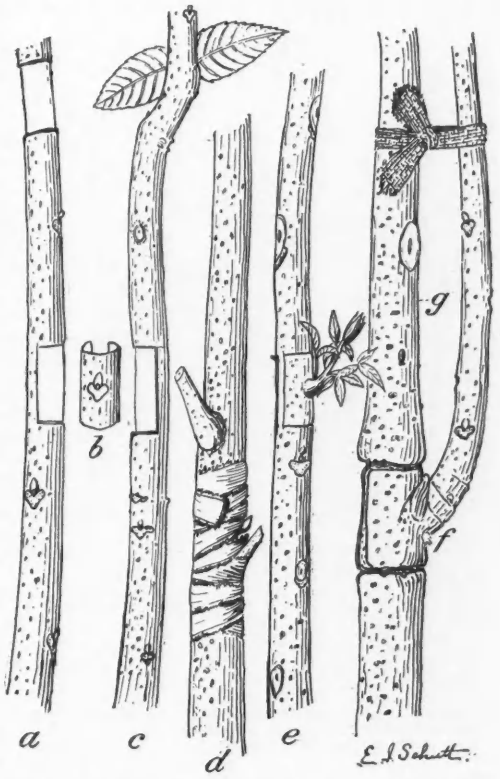

FIGURE 8.—Annular budding: *a*, Bud stick from which the bud has been removed; *b*, the bud ready for insertion in the matrix of the stock; *c*, the stock ready to receive the bud; *d*, the bud after being placed in position and carefully wrapped; *e*, growth taking place, the wrapping having been removed; *f*, growth from the bud supported by being tied to the stock (*g*) above the union. Note the scars above the union, where the buds were removed in order to direct the flow of sap to the new bud.

CHIP BUDDING

Propagation by chip budding is performed in the early spring or late in the dormant period. Because of being done at this season it is also known as "dormant" budding. With a sharp knife a downward cut is made below the bud on the bud stick to a depth of perhaps one-eighth of an inch. Raising the knife to a point above the bud, a long downward cut is made, which meets the lower end of the first cut, and the bud is removed with a chip attached, as shown in figure 9. A similar chip is removed from the stock, and the desired bud is put in its place. This should be carefully wrapped with such material as will hold the cambium layers of the stock and the bud firmly together on at least one side.

Subsequent treatment similar to that already described for annular and patch budding should be given young trees propagated in this manner.

Trees of the pecan species are difficult to propagate asexually, that is, neither buds nor scions "take" with the readiness of ordinary fruit trees. The inexperienced operator, therefore, must expect a very low percentage of living buds as the result of his first attempts. Skilled propagators, however, are now so

successful that under favorable conditions the percentage of failures is no longer a matter of consequence.

No attempt to bud pecans should be made on rainy days, or in early mornings following heavy dews. Some nurserymen even go so far as to select their men for budding the pecan, assigning those who perspire most freely to other duties. Extremely hot days should be avoided, especially if accompanied by drying winds. Moderately cool, cloudy days without wind or rain are the best for pecan budding.

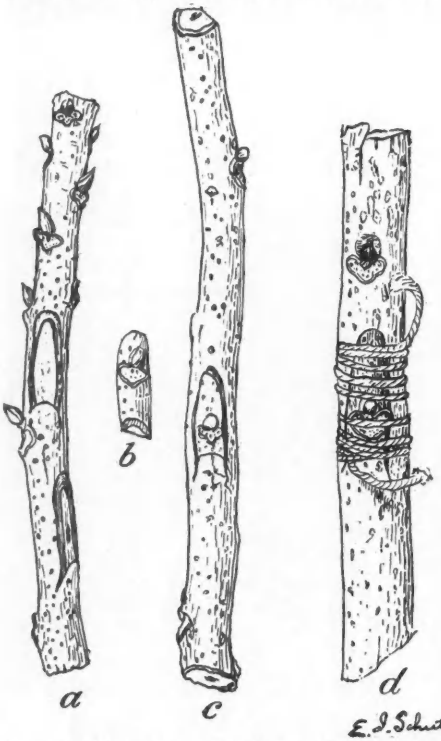

FIGURE 9.—Chip or "dormant" budding. *a*, The bud stick; *b*, the bud ready for insertion; *c*, the bud inserted in the matrix of the stock; *d*, the bud securely tied in place.

Figure 10 shows a persimmon chip bud which has made considerable growth.

PROTECTION OF BUDS

A very satisfactory means of affording protection to buds inserted by any of the foregoing methods is shown in figure 11. These waxed shields are intended as a substitute for the waxed strips previously mentioned, and their preparation and use has been described as follows:[4]

In making the waxed wrappers, old domestic from worn bed sheets or undergarments may be used. Tear it into strips 2 feet long and 6 inches wide; then fold it into squares and dip it into a tin plate of hot, melted beeswax. The wax will strike through instantly, and then the strips may be held up by one end and the surplus wax allowed to drip back into the tin plate. When cool, the cloth may be torn into * * * squares of proper size. No pressing or squeezing is necessary. The beeswax answers the purpose in every way; it saves the buds, and that is the end in view. These wrappers may be left on the buds the whole season. When the bud shoots are an inch or so in length, the strings may be unwound from so much of the wrappers as cover the buds; but tie the upper end of the wrapper, which is above the bud, firmly to the projecting stub. The eyelets[5] in the wrappers will open as the bud shoots grow, and protection will be afforded against hot suns and chilly nights.

CLEFT GRAFTING[6]

This style of graft is particularly adapted to large trees when for any reason it becomes necessary to change the variety. Branches too large to be worked by other methods can be cleft-grafted.

A branch 1 or 1½ inches in diameter is severed with a saw. Care should be taken that the bark be not loosened from any portion of the stub. Split the exposed end with a broad, thin chisel or grafting tool (fig. 12, *a*). Then with a wedge or the wedge-shaped prong at the end of the grafting tool spread the cleft so that the scions (fig. 12, *b*) may be inserted (fig. 12, *c*).

[4] From American Fruit and Nut Journal, v. 6, no. 94, p. 22.
[5] The eyelet referred to is the small hole in the center of the protector shown in fig. 11.
[6] See footnote 1.

The scion should consist of a portion of the previous season's growth and should be long enough to have two or three buds. The lower end of the scion, which is to be inserted in the cleft, should be cut into the shape of a wedge, having the outer edge thicker than the other. In general, it is a good plan to cut the scion so that the lowest bud will come just at the top of this wedge, so that it will be near the top of the stock. The importance of having an intimate connection between the growing tissues of both scion and stock cannot be too strongly emphasized, for upon this alone the success of grafting depends. To make this contact of the growing portions doubly certain, the scion is often set at a slight angle with the stock into which it is inserted, in order to cause the growing portions of the two to cross.

After the scions have been set the operation of cleft grafting is completed by covering all cut surfaces with a layer of grafting wax.

Cleft grafting has given satisfactory results with the persimmon, both on the branches (fig. 13) and at the crown (fig. 14).

FIGURE 10.—A chip bud on a branch after the bud inserted had made considerable growth.

WHIP GRAFTING [7]

Whip grafting is the style almost universally used in root grafting. It has the advantage of being well adapted to small plants.

The graft is made by cutting the stock off diagonally—one long smooth cut with a sharp knife, as shown in figure 15, *a*. Place the knife about one-third of the distance from the end of the cut surface, at right angles to the cut, and split the stock in the direction of its long axis. Cut the lower end of the scion in like manner (fig. 15, *b*), and when the two parts are forced together, as shown in figure 15, *c*, the cut surfaces will fit neatly together, and one will nearly cover the other if the scion and stock are of the same size. A difference in diameter of the two parts to be united may be disregarded unless it be too great. After the scion and stock have been locked together, as shown in figure 15, *c*, they should be wrapped with five or six turns of waxed cotton to hold the parts firmly together.

While top grafting may be done in this way (fig. 16), it is in root grafting that the whip graft finds its distinctive field. When the roots are cut into lengths of 2 to 5 or 6 inches to be used as stocks, the operation is known as piece-root grafting. Sometimes the entire root is used.

In ordinary propagation by means of whip grafts, the scion is cut with about three buds, and the stock is nearly as long as the scion. The graft is so planted as to bring the union of stock and scion not very far below the surface of the ground.

CARE OF WHIP GRAFTS [8]

When grafted by the whip-graft method the young trees will require little subsequent attention other than pruning and ordinary cultivation. When the root is that of a very young tree there will be no danger of the supply of plant food being such as to induce a growth of top that is too rapid, as is frequently the case with cleft grafts, especially in the tops of old trees. While temporary staking as a support to the union is not necessary, in numerous cases stakes will be highly essential to insure erect growth. The moisture of the ground causes the wrapping material to decay in the course of a few weeks, and it is therefore not necessary to cut the bands.

[7] See footnote 1.

[8] See footnote 2.

The operation of grafting most fruit trees is generally successful if performed in the spring when the trees are still dormant, or even after growth has started slightly, provided the scions are entirely dormant. In the case of the persimmon, however, much more satisfactory results appear to be obtained when the grafting is delayed until the trees have definitely started into new growth. The scions must be kept dormant.

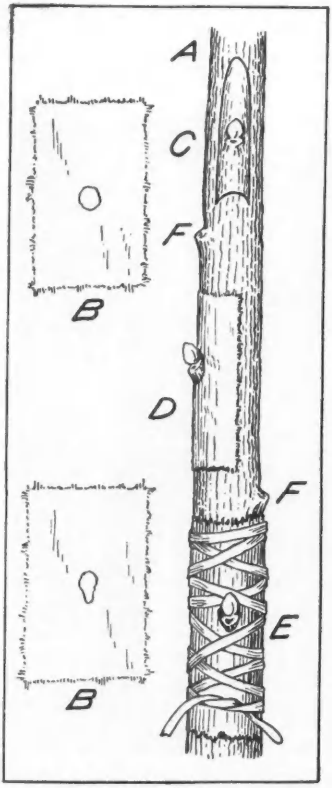

FIGURE 11.—Method of using a bud protector on a chip bud. The protector may be used in a similar manner in all of the different forms of budding. *A*, Stock; *B*, *B*, waxed cloth protectors; *C*, chip bud fitted into notch in stock; *D*, protector in position over the bud; *E*, protector and bud wrapped and tied; *F*, *F*, scars of buds removed from stock. (Adapted from drawing in American Fruit and Nut Journal, vol. 6, whole no. 94, p. 23.)

In all of the various methods of budding and grafting the persimmon it is of the utmost importance that the cut surfaces of both bark and wood be protected with as little delay as possible from chemical change due to exposure to the air. Protection is afforded by covering the wounds with grafting wax, waxed cloth, or similar devices.

STOCKS AND NURSERY TREES

The stocks in the nursery row should stand at least 6 inches apart, to afford space for root development and to give the workmen plenty of room when the trees are budded or grafted. The young trees in the nursery should receive fair cultivation, and the roots should be pruned each year with a tree digger or spade, in order to keep the root system small enough to be handled with ease when the trees are dug. The 2-year-old roots are always preferable for stocks. Older roots which are small enough to be easily handled are likely to be stunted, and 1-year-old roots must be very thrifty to produce the desired growth in the graft.

Trees which have been produced under conditions favorable for development may be planted in their permanent location after they have made one season's growth in the nursery. Some varieties, however, are much more vigorous than others. It may be advisable to grow the weaker sorts in the nursery for 2 years before transplanting them. Figure 17 shows two varieties of grafted persimmon trees that have made one season's growth in the nursery.

On account of the very long taproot which persimmon trees habitually develop, particularly when propagated on seedling stocks, much care must be exercised to avoid undue injury to the root systems

when the trees are dug from the nursery. Moreover, because of the deep-rooting habits of these trees a deep soil should be selected for their permanent location.

CULTIVATION

PLANTING

The transplanting of the young trees may be done at any time during the dormant period, from late autumn to early spring, when the roots can be protected from freezing temperatures and evaporation and when the soil is in a suitable condition for handling. If the trees have been properly taken up without undue injury to the roots, the tops will need little or no pruning. If, on the other hand, the root systems have been severely reduced, the tops should be headed back until the total length of branches and trunks corresponds in a general way to the total length of the main roots. Wounds on both tops and roots should be waxed as soon as made.

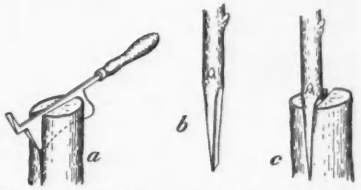

FIGURE 12.—Cleft graft: *a*, Stock being split by special grafting tool; *b*, scion ready for insertion; *c*, scion in place ready for waxing.

FIGURE 13.—A cleft graft made on a small branch.

Young persimmon trees have large, deep root systems and should be planted 2 or 3 inches deeper in the orchard than they were in the nursery row. In setting them out the soil should be packed thoroughly around the roots. A round-pointed wooden tamp is a very serviceable tool with which to make the earth compact as the hole is filled up. The planting plan varies with the type of tree desired. If it seems desirable to grow low-headed trees with the expectation of producing large fruit that can be readily picked by hand, the permanent trees should be placed at least 16 or, better still, 20 feet apart each way. If, however, a large bulk of fruit is desired as stock feed to be scraped from the ground or picked up by animals, a fair degree of success may be expected if the trees are planted 10 feet apart each way.

TILLAGE

Probably the persimmon can be more successfully intercropped than any other fruit tree, owing to the depth of its root system. Blackberries, dewberries, strawberries, and vegetables thrive very well among persimmons until the shade becomes too dense. When

the trees shade the ground, it is best to seed down the orchard if it is to be used as a run for chickens, calves, pigs, or other animals, and the fruit used as stock feed. If it is planned to produce fruit for market purposes, however, the same cultivation should be given the ground as in a commercial orchard of peach or other fruit trees.

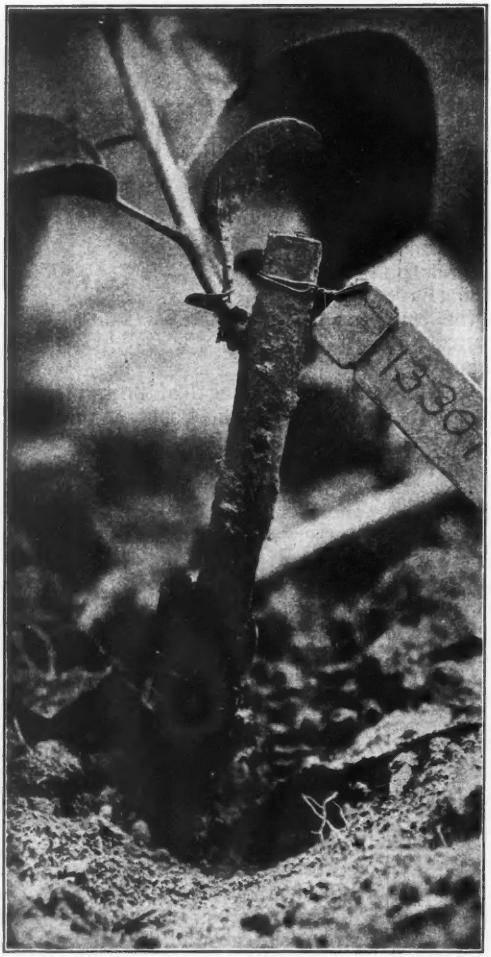

FIGURE 14.—A cleft graft made at the crown, the soil which normally covered the union having been removed in order to show the parts to better advantage.

PRUNING

The pruning of the persimmon varies with the variety. There is a tendency for the tree to prune itself, as many of the fruit-bearing twigs die and drop off with their fruit, thus making the natural open growth of the trees still more open and reducing to a minimum the necessity for pruning. There are two points, however, which should be borne in mind: (1) The upright tendency of some of the most vigorous varieties should be checked by pinching off the tender growing tips as they get out of reach, and (2) those trees that do not prune themselves sufficiently to keep the top well open should be thinned by removing entire limbs, either main or secondary. This practice is preferable to opening the tops by thinning out the small branches and thus leaving the larger limbs bare for a considerable portion of their length. Thinning admits light and air, and at the same time a stronger vegetative growth is induced; the result is that the size of the fruit is kept uniform and the crops are made more regular by reducing the tendency to overbear on alternate years.

All wounds should be painted or otherwise covered as soon as made, in order to prevent the wood from drying or dying back and decay from entering the body of the trees.

DISEASES AND INSECT PESTS

The persimmon is exceptionally free from the attacks of diseases and insect pests. Probably the most important of the insect enemies of the persimmon is the hickory twig girdler. The following brief account of the life history and habits of this insect, prepared for this bulletin by the Bureau of Entomology and Plant Quarantine, may be of interest to those who anticipate growing the persimmon:

The hickory twig girdler, *Oncideres cingulata* Say, makes its appearance about the middle of August and may be found until the first of October. It begins depositing its eggs about the latter part of August and continues the process well into October. The eggs hatch in from 7 to 9 days after deposition, and the young larva begins to feed on the inner bark and wood at the point where the egg was inserted beneath the bark. As the larva increases in size it continues to feed on the wood, going deeper into the twig and by the time its full growth has been attained it often completely hollows out the twig for some little distance from the point where it began work. Some of the larvae attain their full growth and begin transformation to pupae about the first of August. Others do not make this change until near the middle of September. The pupal stage lasts from 10 to 14 days, when the insects transform to adults and emerge from the twigs where they have spent their lives. Several days pass before they begin laying their eggs in the small limbs and twigs.

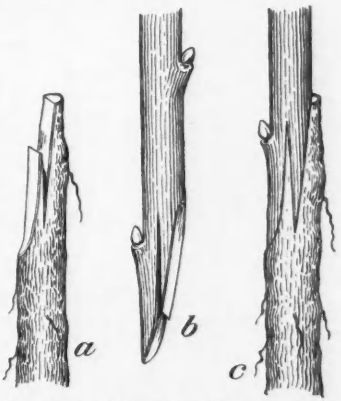

FIGURE 15.—Whip graft: *a*, Stock prepared; *b*, scion prepared; *c*, stock and scion fitted together ready for tying.

The injury caused by this insect occurs in the process of oviposition. The adult gnaws a small hole in the bark, usually just above or just below a bud, and the egg is inserted beneath the bark by means of the ovipositor. Several eggs are usually deposited in a twig in this manner, and the insect then begins girdling the twig beneath the point of oviposition by gnawing out small pieces of the bark. A ring is thus made around the twig, perhaps a third of the way through, weakening it to such an extent that it is broken off by the wind during the winter or the following spring. The trees are often severely injured by having the young growth pruned off in this manner.

In order to control this insect the twigs should be picked up from the ground in June or early July. All twigs which are found at this time have been girdled and broken from the tree and should be collected and burned in order to destroy the insects which are inside them.

USES OF THE PERSIMMON TREE

In comparatively recent years the annual consumption of persimmon wood has amounted to as much as 8,000 cords for dimension stock, more than 80 percent of which was made into shuttles, used in the textile industry. The most of the remainder was made into golf-club heads and shoe lasts; nearly 1,000 cords, the equivalent of 500,000 board feet, log scale, going into golf clubs. Besides dimension stock, some 25,000 board feet of persimmon lumber is commonly produced annually. This is used for various purposes where a smooth surface that does not tend to splinter with use is required.

HANDLING THE FRUIT

Probably the most common use of the fruit is as feed for hogs. As a rule, the hogs are merely turned loose in lots where persimmon trees have come up naturally. Such natural groups may contain trees on which the fruit will ripen in a continuous sequence, furnishing forage for hogs from the last of August until early winter. A small area devoted to persimmons can thus be made a valuable asset for any general farm located in a persimmon district which includes hogs among its stock.

FIGURE 16.—A whip graft after attaining considerable growth.

The persimmon fruits intended for shipment should, to avoid bruising, be carefully handpicked while still quite firm, that is, just as the flesh begins to soften. Fruits which can be delivered direct to the consumer should not be picked until fully mature and should also be handled with great care. Fruit of the later varieties, especially those of the oblong type, often hang on the trees for weeks, drying to about the consistency of the commercial date.

Quart and pint berry boxes are commonly used when packing the fruit for market, the baskets being handled in the ordinary strawberry crate. Larger units would result in bruising the softer fruits and are therefore not advisable.

VARIETIES

There were briefly characterized in the original issue of this bulletin in 1915, 13 named varieties of native persimmons most of which had been commercially propagated at one time or another. Of that number, the Josephine and Ruby are the only varieties now (1935) being propagated by any nursery so far as known. Since 1915 a half-dozen or so other varieties have been named and offered to the trade. The propagation of most of these has apparently been discontinued. The Glidewell, however, has been listed recently by 1 or 2 nurseries. Though this change in the status of native persimmon varieties doubtless indicates a changing interest in this fruit as compared with that of 20 years ago, many inquiries are still received at this Department in regard to the fruit.

The suggestions given in the following paragraphs for serving native persimmons are based on tests [9] made with fruit of the Miller, Josephine, Ruby, Hicks, and Kawakami varieties grown at the

[9] These tests were made by the Bureau of Home Economics and the following recipes, based on these tests, were prepared in that Bureau.

Arlington Experiment Farm, Rosslyn, Va., near Washington, D. C. Fruit so ripe that it had dropped from the trees, and also less mature fruit picked from the trees, was used. The different varieties were judged for quality and utilized in various ways. The Miller and Ruby were thought to have the best flavor, with less astringency and more body than the others. The Josephine and Hicks were less uniform in astringency. Some of the ripe fruits of each variety were quite astringent; others were free from astringency. The Kawakami, a supposed accidental hybrid between the Josephine and the Yemon, a Japanese variety, was considered less desirable than either the Miller or Ruby, as it was less sweet and had less flavor, and the flavor was not entirely pleasant. There seemed to be little difference in the quality of the tree-ripened fruit which had dropped to the ground and the less mature fruit picked from the trees and ripened at room temperature before it was used.

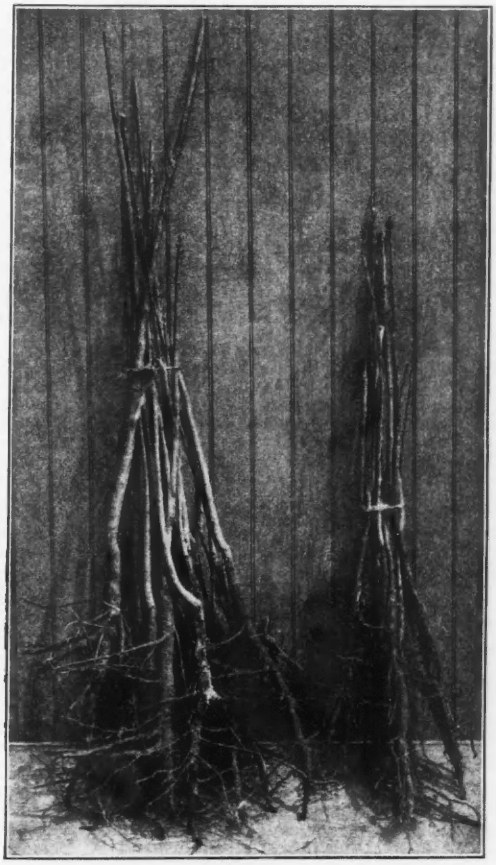

FIGURE 17.—Persimmon trees after making one season's growth in the nursery. These trees were propagated by grafting on seedling stocks. The bundle on the left is the Golden Gem variety; on the right, the Miller. The largest trees are 4 to 5 feet tall. The difference in the size of the trees in the two bundles is due to the difference in the natural vigor of growth of these two sorts.

USING THE PULP

As compared with other fruits, the native persimmon ranks high in sugar content, as is shown by chemical analyses reported in Proximate Composition of Fresh Fruits, Department of Agriculture Circular 50, but for other points on food value, such as vitamins and the minerals important in nutrition, no data are as yet available.

Before the advent of the white man, the Indians mixed the pulp of the persimmon with crushed corn and made it into a kind of bread, and, following the modern ideas of cookery, the Food Utilization Section of the Bureau of Home Economics finds that persimmons can be used in a variety of ways.

The astringency of persimmon pulp may be counteracted to some extent if soda is added to the pulp before it is heated. The quantity of soda to use varies with the degree of ripeness and the variety of the fruit, but one-half teaspoon of soda to 1 cup of the persimmon pulp is an average. Persimmons will discolor if cooked in tin utensils; also products made without additional acid will blacken before serving.

RECIPES FOR SERVING

BAKED PERSIMMON PUDDING

2 cups persimmon pulp
3 eggs
1¾ cups milk
2 cups sifted flour
1 teaspoon soda
1 teaspoon salt
½ teaspoon cinnamon
½ teaspoon nutmeg
1½ cups sugar
3 tablespoons melted butter

Mix the persimmon pulp, beaten eggs, and milk. Sift the dry ingredients together and pour the liquid mixture into them. Stir in the melted butter and pour into a shallow greased pan to the depth of about 2 inches. Bake for about 1 hour in a very moderate oven (300° to 325° F.). When cold, cut into squares and serve with plain or whipped cream.

STEAMED PERSIMMON PUDDING

¼ cup butter
½ cup sugar
2 eggs
1½ cups persimmon pulp
3 teaspoons soda
½ cup flour
2 teaspoons baking powder
¼ teaspoon salt

Cream the butter, add the sugar, beaten eggs, and persimmon pulp. Sift the remaining dry ingredients and combine with the first mixture. Pour into a greased mold, cover, and steam for 1½ hours.

PERSIMMON CUSTARD

2 cups persimmon pulp
½ cup sugar
1 teaspoon soda
2 egg yolks, beaten slightly
¼ teaspoon cinnamon
⅛ teaspoon nutmeg
1/16 teaspoon salt

Combine the ingredients, pour into a baking dish surrounded by hot water, and bake in a slow oven (250°–300° F.) for about 15 minutes.

Make a meringue, using two egg whites, one-fourth cup of sugar, and one-sixteenth teaspoon of salt. Place on top of the custard and bake in a slow oven (250°–300° F.) until lightly browned.

PERSIMMON WHIP

1 cup persimmon pulp
½ teaspoon soda
½ cup sugar
5 egg whites
¼ teaspoon salt
3 tablespoons lemon juice

Heat the persimmon pulp with the soda and sugar. Fold the hot mixture into the stiffly beaten egg whites to which the salt has been added. Mix in the lemon juice, place in a baking dish surrounded by hot water, and bake in a very slow oven (225°–250° F.) for about 1 hour.

PERSIMMON CORNSTARCH PUDDING

½ cup sugar
⅓ cup cornstarch
⅛ teaspoon salt
½ cup cold water
1½ cups boiling water
½ teaspoon soda
1 cup persimmon pulp
¼ teaspoon cinnamon
1 tablespoon lemon juice

Mix the sugar, cornstarch, salt, and cold water thoroughly in a double boiler. Add the boiling water and stir until the mixture thickens. Add the soda to the persimmon pulp and combine with the cornstarch mixture. Cover and cook for 15 minutes. Add the cinnamon and lemon juice, pour into a mold, and chill. Serve plain or with cream.

PERSIMMON CAKE

½ cup fat
1 cup sugar
1 cup persimmon pulp
2 eggs
½ teaspoon soda
2 cups flour
3 teaspoons baking powder

Cream the fat and sugar together, add the persimmon pulp and beaten eggs. Sift the dry ingredients and add to the liquid mixture. Beat well, pour into a greased pan, and bake in a moderate oven (325°–375° F.) for about 1 hour.

PERSIMMON SHERBET

1 cup water
1 cup sugar
2 cups persimmon pulp
Juice ½ lemon
⅛ teaspoon salt
1 egg white

Boil the water and sugar for 1 minute, and put aside. When cold, add the persimmon pulp, lemon juice, salt, and unbeaten egg white, and freeze with a mixture of 1 part salt to 4 to 6 parts of ice. Turn the crank slowly until the mixture is firm. Remove the dasher, pack the freezer with more ice and salt, and let the sherbet stand for an hour or more to ripen.

PRESERVED PERSIMMON PULP

Mix equal amounts by measure of persimmon pulp and sugar and place in glass jars. Partially seal and process pint jars for 15 minutes in a boiling water bath. Seal and store in a cool place.

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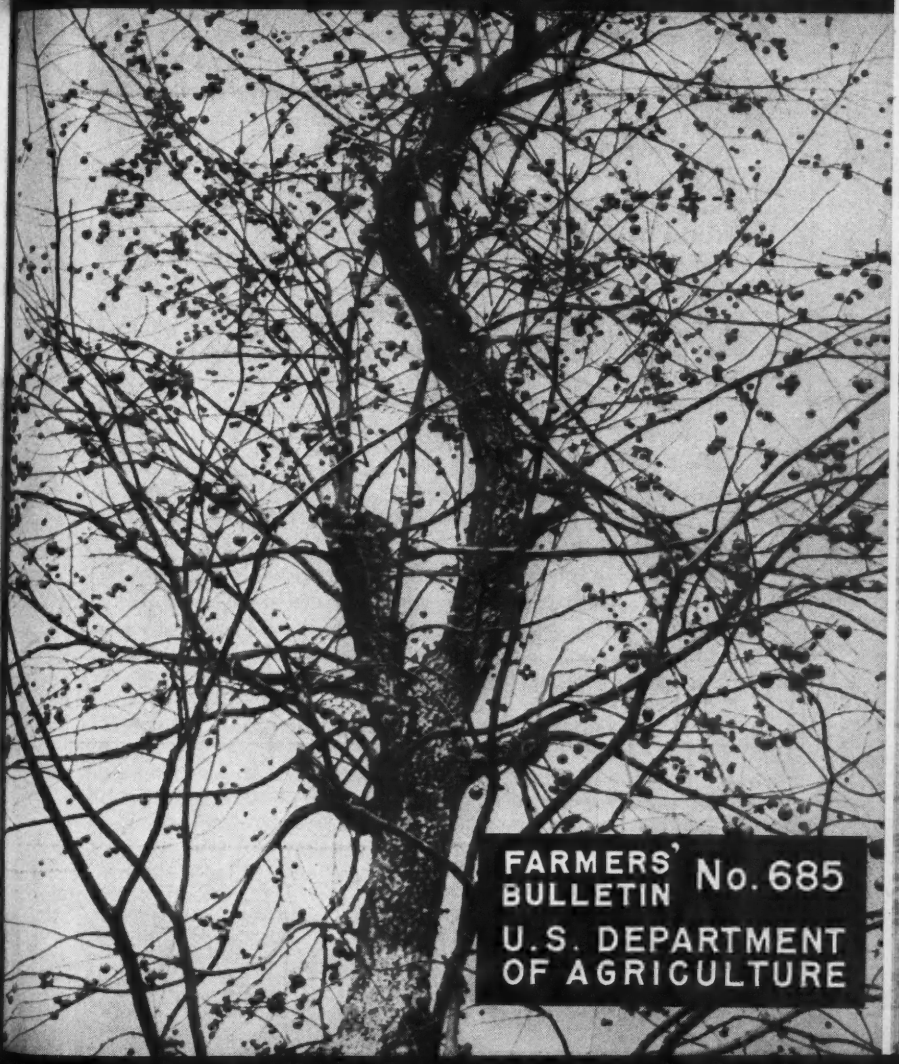
The NATIVE PERSIMMON



FARMERS' BULLETIN No. 685
U.S. DEPARTMENT OF AGRICULTURE

THE NATIVE PERSIMMON is considerably prized as a fruit-producing tree by many who are familiar with it in its natural range of distribution and have opportunities to eat the fruit at its best; the fruit is considerably derided and scorned by many who think only of its extreme astringency when eaten before it is fully mature and in "good eating condition."

As is the case with some other native fruits, little has been done to improve the persimmon. A number of selections have been made of trees producing superior fruit in the wild, and these have been named and propagated for the trade. During the second decade of this century the number of such varieties probably reached its maximum. In the more recent years, apparently from lack of demand for the trees, most nurseries have ceased to propagate them, with the result that at the present time (1942) trees of probably not more than a half dozen named varieties are available to the trade.

Recently there has appeared a serious wilt disease which threatens the existence of the American persimmon, at least in the Southern States.

The persimmon tree is of value as an erosion-control plant and its wood also is valuable for making golf-club heads, shuttles, and other articles.

This bulletin sets forth methods of propagation and care of the trees, calls attention to some of the merits of the fruit and, in particular, supplies some recipes for its use in cookery.

Washington, D. C.

Issued October 1915
Revised September 1923
Revised August 1935
Revised May 1942

THE NATIVE PERSIMMON

By W. F. FLETCHER, formerly *scientific assistant, Office of Horticultural and Pomological Investigations, Bureau of Plant Industry* [1]

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THE PERSIMMON seems to have been the first native American fruit to be described and praised by the early explorers. De Soto learned its food value in 1539, and in 1557 published an account of it at Evora, Portugal. The following year, 1558, Jan de Laet described the persimmon in his work on Virginia. John Smith's narrative of the settlements and resources of the New World, written during the first years of the seventeenth century, included a long discussion of the persimmon. In his reference to this fruit, where he says "If it be not ripe, it will draw a man's mouth awrie with much torment," he so well characterizes the puckering, astringent effect of the tannin contained in the immature fruit that no other comment is necessary.

The persimmon tree has received more criticism, both adverse and favorable, than almost any other known species. Those who have discussed the food value of the fruit, from the earliest chroniclers to recent writers, have prophesied that the tree would soon be accorded a place in our gardens and orchards. Those people, on the other hand, who have been acquainted only with the immature fruit or with the young sprouts in cultivated fields have had nothing to say in its favor and have bent their energies toward its destruction rather than its propagation and cultivation.

Several factors are responsible for the slow progress of persimmon development in this country. One reason for the neglect of this fruit seems to be the erroneous yet oft-repeated statement that persimmons are unfit to eat until they have either been touched by frost or frozen. Although this statement has been corrected by nearly everyone who has studied the subject, nevertheless throughout the regions where persimmons are grown many of the best fruits are lost

[1] Revised by H. P. Gould, formerly principal horticulturist, in charge, Division of Fruit and Vegetable Crops and Diseases.

each year because they ripen and fall before frost or before they are supposed to be edible. The truth of the matter is that freezing is as detrimental to the quality of persimmons as to the quality of any other fruit. If persimmons are not edible and free from astringency before frost, it is because the variety is a late one and the fruit has not yet matured.

The development of the persimmon, whether for orchard or ornamental purposes, has been retarded by the difficulty encountered in propagating and transplanting it. One grower has characterized it as the only tree that he could not kill in his cultivated fields and the only one that he could not make live in his garden. Failure in transplanting is usually due to a lack of knowledge concerning the characteristic root development of the persimmon. Under natural conditions, the roots penetrate much deeper into the soil than those of most other fruit trees, and unless great care is exercised when the tree is taken up it is almost impossible to get more than a small percentage of the root system, thus reducing the chance of making the tree live when transplanted.

From time to time valuable trees have been discovered, cared for, and even in some cases transplanted or propagated. Most of these have been soon neglected or destroyed, until there are comparatively few varieties of marked value available for general distribution.

Both De Soto and Jan de Laet when describing the ripe fruit of the native persimmon call it a "delicious little plum," and John Smith and other writers of the seventeenth century speak of it as a plum with the flavor of an apricot. This use of the word "plum" doubtless directed the attention of many people away from the persimmon to the native species of *Prunus*, which include our wild cherries and plums.

NATURAL DISTRIBUTION

The persimmon, which belongs to the ebony family (Ebenaceae) and is known to botanists as *Diospyros virginiana* L., is the only member of the family that is indigenous to any extensive portion of this country.

Roughly speaking, the persimmon is indigenous to the southeastern quarter of the United States, being found in large numbers in the fields and forests of that region. The more favored localities in southern Iowa and southeastern Nebraska produce many fruits, but very few trees are found west of eastern Kansas. Scattering specimens in Connecticut and on Long Island mark the present northeastern limit of the species. A few trees in Rhode Island, New York, and Michigan, which produce fairly well, indicate that the northern limit of cultivation may be extended whenever economic conditions (that is, the value of the fruit for food or of the tree for ornamental purposes) seem to warrant.

The zone of greatest productivity and adaptability, wherein appear by far the largest number of promising types, extends from Maryland, Virginia, and the Carolinas westward through Missouri and Arkansas. The persimmon thrives equally well on the sands of the Coastal Plain, the shales of the Allegheny Mountains, the muck of the river-bottom lands, and the chert of the Ozarks.

GENERAL DESCRIPTION

HABIT OF GROWTH

Throughout the range of the persimmon there is a wide variation in the size and growth of the trees and in the form, size, color, and number of seeds of the fruit. The tree characters seem to indicate two types, upright and drooping, and these tree types are closely allied with the fruit types.

When grown in the open, persimmon trees rarely reach a height of 50 feet. In a dense forest growth they sometimes reach 70 or 100 feet, but that is uncommon. The characteristic checking of the bark of an old tree, which is shown in figure 1, aids one to recognize the species. The top of the tree is usually roundish or conical in form. Large trees are often somewhat irregular, owing to the breaking of limbs by heavy crops of fruit; moreover, it is a characteristic of productive trees to prune themselves by dropping many of the fruit-bearing twigs. The branches are always spreading, often coming out almost at right angles to the trunk and then drooping more or less, especially after the tree has borne a few crops.

The leaves are elliptical or slightly ovate in form, acuminate, or tapering, at the apex. They measure from 3 to 6 inches in length and 1 to 3 inches in width, and have a short petiole. In color, they are a dark glossy green on the upper surface and a grayish green underneath. Trees differ markedly, however, in habits of growth, as is shown in figures 2 to 4.

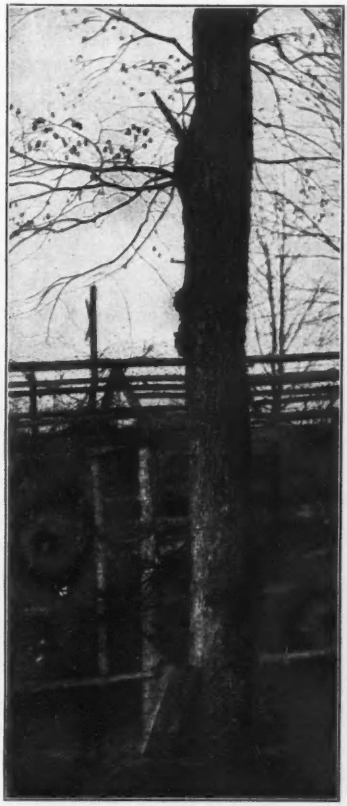

FIGURE 1.—An old persimmon tree, which shows the characteristic checking of the bark.

FLOWERING HABIT

The flowers resemble little lipped urns of wax, from one-fourth to three-fourths of an inch in length, ranging in color from a greenish yellow to a milky white. They are borne on short stalks and appear from the last of April in the extreme South until the middle of June at the northern limit of the persimmon range.

The trees are generally dioecious; that is, the pollen-bearing and fruit-producing flowers are borne on separate trees. The pistillate or fruit-producing flowers are borne singly, whereas the staminate or pollen-bearing flowers are generally produced in threes. The pollen

is very light and powdery, and, although it is generally distributed by the bees that frequent the trees in great numbers during blossoming time, it can also be carried to great distances by the wind.

FRUIT CHARACTERS

The fruit is a true berry, containing sometimes as many as eight seeds in its pale, translucent flesh. It varies in form from oblate to oblong and in diameter from three-fourths of an inch to 2 inches. It ranges in color from yellow to pale orange and even to a dark red, with many varietal markings, and is often blushed and covered with a bluish bloom. When green, persimmons are generally very astringent and puckery, because of the large quantity of tannin contained in the flesh, but when they are thoroughly mature and ripe the flavor is rich and sweet, and the consistency varies between that of a baked apple and a soft custard. The fruits of many late varieties turn a rich dark red and partially dry on the trees.

FIGURE 2.—A persimmon tree of the upright type that produces large, oblate fruits used here as a dooryard tree.

PRESENT EVALUATION OF THE FRUIT

Throughout the region where persimmons are found in abundance the fruit is considered as being "good for dogs, hogs, and 'possums." Probably the most common use of the fruit is as feed for hogs. As a rule, the hogs are merely turned loose in lots where persimmon trees have come up naturally. Such natural groups may contain trees on which the fruit will ripen in a continuous sequence, furnishing forage for hogs from the last of August until early winter. A small area devoted to persimmons can thus be made a valuable asset for any general farm that is located in a persimmon district and includes hogs among its stock. Persimmon fruit is also valuable as a food for wildlife of various kinds.

Occasionally a family is mentioned as having lived for several months upon the fruit from a single large tree. In some of the large cities and towns within the persimmon range, the wild fruit can be purchased during the autumn and early winter from the dealers who occupy the open stalls in the public markets. A few enterprising growers adjacent to large cities have built up a demand for the fruit.

The methods of utilizing the persimmon fruit are at present rather limited. Fresh fruit is used in various ways—in making a few kinds of pudding, sherbet, cake, etc. (see p. 22).

POSSIBILITIES OF IMPROVEMENT

The season of the native persimmon is probably longer than that of any other wild fruit, both locally and over the country as a whole. In many sections the earliest and the latest varieties may be found growing side by side, or at least within a few miles of each other. The Bureau of Plant Industry has records for both early and late varieties from the southern part of Georgia and Florida. In the District of Columbia there have been trees which ripened their fruit in August and others on which it hung until February.

Generally speaking, the best fruits are neither the earliest nor the latest. The latest varieties are still immature when the leaves fall or when they are killed by frost, and they must complete the ripening process within themselves instead of drawing nourishment from the tree until they have grown to maturity.

FIGURE 3.—A persimmon tree of upright habit of growth that produces fruit of the pyriform type, ripening in midseason.

The largest as well as the best fruits are those that ripen about the time the trees shed their leaves. The fruits of the early varieties are nearly all medium in size, and those of the late varieties, which hang on until cold weather, are generally small. Seedless fruits, as a rule, are smaller and earlier than those with seeds produced on the same trees.

The wide variations shown by the fruit in size, color, season of maturity, and tendency to seedlessness, and by the trees in size, shape, and vegetative vigor indicate the possibility of greatly improving the native persimmon. Up to the present time one essential factor has been overlooked in all attempts at breeding better varieties. That factor is the parentage of the male or pollen-bearing trees. Without a knowledge of the characters represented in the male parent there is no certainty as to the results of the crossing and no possibility of the line breeding essential to the rapid development of improved varieties.

Definite efforts should be made in breeding work to obtain pollen-bearing trees of known parentage. They should be selected from among trees grown from seed produced on the most desirable fruit-bearing trees.

The discovery within recent years of a very destructive and rapidly spreading wilt injects a new element into the native persimmon situation. In the affected areas, there have not as yet been found any individual trees that show resistance to this disease; however, the potential importance of such trees, should they appear, in the development of resistant strains of the persimmon makes it highly desirable that any specimens manifesting an appreciable degree of resistance be preserved for breeding purposes, whether it be a fruit- or a pollen-producing type. This disease, which appears to threaten the destruction of the native persimmon in the areas where it occurs, just as chestnut blight has destroyed the American chestnut throughout its commercial range, is discussed on page 17.

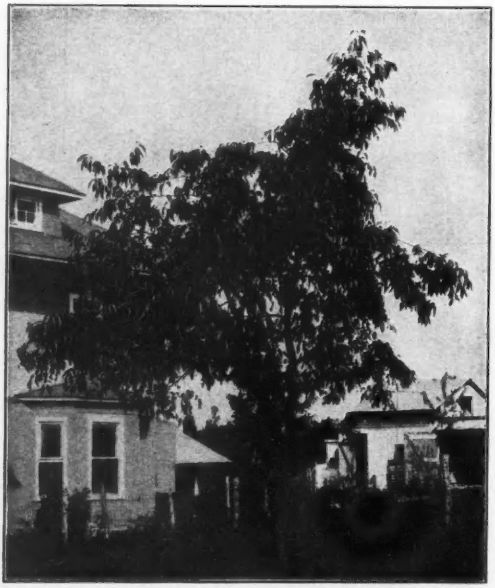

FIGURE 4.—A persimmon tree that has a drooping habit of growth and produces fruit of the oblong type.

VARIETIES

There were briefly characterized in the original issue of this bulletin in 1915, 13 named varieties of native persimmons, most of which had been commercially propagated at one time or another. Just previous to 1941, so far as known, less than half that number were being listed by nurserymen. These include 3 varieties that were named in 1915—the Josephine, Ruby, and Early Golden. Several sorts have been advertised during the past 25 years, only to disappear from the trade lists after a very few years. Only a small number of nurserymen list named varieties at the present time; a very few others list "American persimmons," but such listings are understood to refer to seedling trees, not to named selections. These named varieties are all selections made from trees growing in the wild, with possibly one exception; the Kawakami variety originated as a chance seedling, which, when introduced, was supposed to be a hybrid between the native and oriental species. That view, however, now seems untenable.

Though this change in the status of native persimmons doubtless indicates a decrease in interest in this fruit as compared with that which prevailed when this bulletin was first issued, frequent inquiries

concerning the persimmon are received at the United States Department of Agriculture.

PROPAGATION

As is the case with most tree fruits, the persimmon does not reproduce its varietal characteristics through the seed, and other methods of propagation are, therefore, necessary to perpetuate desirable varieties. Propagation of the persimmon by the methods commonly employed with tree fruits is more difficult than for such fruits as the apple or the peach. The methods described herein have been found successful in actual practice.

SEEDING

The seeds of the persimmon are scattered by mammals and birds and in the natural sequence of events reach the ground in the fall or winter without becoming dry. They are lightly covered with grass or leaves and are subjected to the varying temperatures of winter, always remaining moist. The following spring the seeds sprout as soon as the soil becomes warm enough, provided the conditions accompanying the rise in temperature do not dry them unduly. Seeds that fall under the trees are usually too much exposed to the atmosphere and dry too much to admit of germination.

Seeds that are gathered for propagating purposes should be stratified at once. If they are allowed to dry out it is often necessary to soak them for 2 or 3 days before planting them, the water being renewed each day at a boiling temperature.

The seedbed in which persimmon seedlings are grown should be located on well-drained land where the soil is rather light and well supplied with humus. The ground should be plowed deep with a subsoil plow unless the subsoil is friable enough to permit the ready penetration of the long taproots that characterize the growth of persimmon seedlings.

The seed may be planted either in the fall or spring, after being treated as described above. It is commonly planted in shallow drills and lightly covered with soil to a depth of one-half inch or a little more.

CUTTINGS

Root Cuttings

The roots of persimmon trees sprout readily when the top is removed or when the main stem meets with serious injury. This is illustrated in figure 5, which shows the development of sprouts on the roots of a seedling tree 2 months after the removal of the top. During this period the seedling had been in a propagating bed in a greenhouse, under artificial heat. This illustration also offers an explanation for the occurrence of the large clumps of similar trees that are to be found in many abandoned fields. At some time the original tree was cut off near the surface of the ground and the roots sent up sprouts that, being undisturbed, developed into trees bearing similar fruit.

Roots the size of a lead pencil or larger can be used in propagating the persimmon. They should be cut into pieces 6 or 8 inches long, the ends should be sealed with grafting wax, hot beeswax, or pitch, in order to prevent the decay that develops rapidly in the soft, spongy

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wood, and the cuttings should then be buried over winter in sand or in a nursery row. They will grow readily the following spring, provided the moisture supply is plentiful until they become well established.

Hardwood Cuttings

Cuttings of the branches may be treated in much the same way as root cuttings. Small 1-year-old twigs are unsuitable for purposes of propagation if they lack sufficient substance to produce the callus and root formation. It is difficult to prevent the organisms of decay from entering the soft, porous, 1-year-old wood. If such wood is used, the cuttings should be waxed at both ends and buried until they have become well callused and the roots have started. They may then be planted in a nursery row and vegetative growth encouraged.

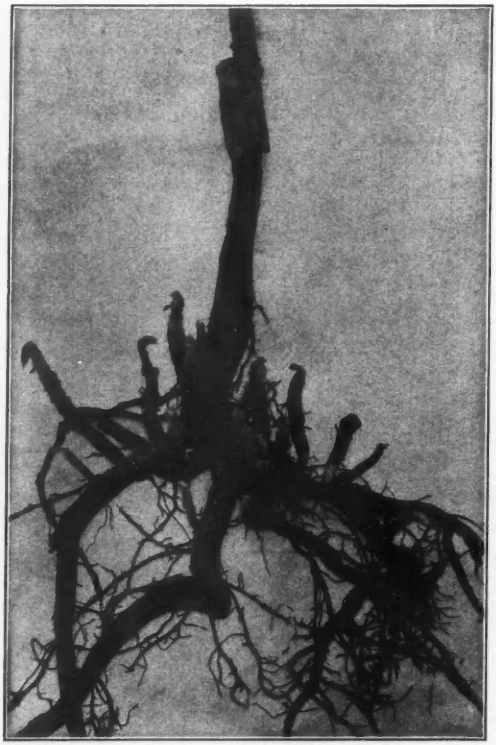

FIGURE 5.—A 2-year-old seedling persimmon tree that has been grafted. It has been in a propagating bed in a greenhouse under artificial heat for 2 months. The sprouts on the roots show how easily the roots may be used as a means of propagating the variety.

Wood 2 or 3 years old may be selected for cuttings, but care must be exercised to procure good, strong buds. The cuttings may be taken at any time after the trees become dormant in the fall and may be placed in cold storage or in sand until wanted. It is most important, however, that the ends of the cuttings should be dipped immediately into melted wax in order to exclude the air. If they have been exposed for even a few hours they should be retrimmed and waxed before being put in cold storage or sand.

BUDDING AND GRAFTING

Those who have trees bearing exceptionally fine persimmons will find the different methods of grafting admirably adapted to top working the worthless trees about the place with the better varieties, thus changing them to useful fruitfulness.

Top-worked, or grafted, portions of old trees will bear 2 or 3 years earlier than trees that come from buds or grafts on 1- or 2-year-old stocks. These seedling stocks, budded or grafted with a selected variety, will bear 1 or 2 years earlier than those produced from cuttings.

The scions to be used in chip budding, cleft grafting, and whip grafting should be cut during later winter. All scions should be kept cool and moist until used. The budding and grafting should be done as soon as the trees that are to be grafted start to grow.

Because of the similarity in the operations of budding and grafting they are treated together. The various methods that have proved satisfactory in propagating the persimmon have been described in detail in publications of the Department of Agriculture relating to other fruits and to nuts. For convenience in the present connection, extracts from these publications are inserted herein.

Selection of Scions and Bud Sticks [2]

When selecting scions and bud sticks care must be exercised, just as when propagating by wood cuttings, to procure wood with strong, well-developed buds. On twigs of the last season's growth the best buds are generally near the base, where they are supported on more mature wood than those near the tip. In wood more than a year old, most of the buds near the tip have already produced branches, thus making this portion of the twig unsuitable for use in budding or grafting.

The method employed in budding persimmons largely determines the character of the wood that should be selected as a source of buds. For the common shield or T-bud, the basal half of the new growth is preferable because the bark is thinner than that on older wood and the buds fit closer and better than where wood with older and thicker bark is used. Moreover, the buds near the base of the new wood are better than those toward the tip, because the latter are so irregular in outline that it is difficult to fit them closely to the stock.

When the chip-bud method is used it is essential that the bud stick have sufficient body to allow the removal of the bud with a clean, solid chip adhering thereto. A bud stick should never be larger than the stock on which the buds are to be worked. If it is too large in relation to the size of the stock that is to receive the bud, the chip will be so broad and flat that it cannot be properly fitted into any notch that it is possible to make in the stock.

For annular or patch budding, the most satisfactory buds are those taken from wood that is 2, 3, or even 4 years old. Such buds are very lightly attached to the wood and have a good body of bark, which makes them easy to handle and not liable to dry out. Buds taken from near the base of large, vigorous, new shoots will also give good results.

Shield or T-Budding [3]

The height at which buds are inserted [where small seedling stocks are used] varies with the operator. In general, the nearer the ground the better. The cut for the reception of the bud is made in the shape of a letter T * * * [fig. 6, *b*]. Usually the crosscut is not quite at right angles with the body of the tree, and the stem to the T starts at the crosscut and extends toward the root for an inch or more. The flaps of bark caused by the intersection of the two cuts * * *

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[2] The bud stick is a branch cut from a tree of the variety to be propagated. (See fig. 9, *a*.)

[3] From Farmers' Bulletin 157, The Propagation of Plants. Out of print, but may be consulted in libraries. See also Farmers' Bulletin 1567, Propagation of Trees and Shrubs.

are slightly loosened with the ivory heel of the budding knife, and the bud, grasped by the leaf stem as a handle, is placed under the flaps and firmly pushed in place until its cut surface is entirely in contact with the peeled body of the stock * * * [fig. 6, *c*]. A ligature is then tightly drawn about, above, and below the bud, to hold it in place until a union shall be formed * * * [fig. 6, *d*]. Bands of raffia about 8 or 10 inches long make a most convenient tying material. As soon as the buds have united with the stock the ligature should be cut, in order to prevent girdling the stock. This done, the operation is complete until the following spring, when all the trees in which the buds have "taken" should have the top cut off just above the bud * * *.

Shield budding may be done at any time when the trees are in vigorous growth and when well-matured buds of the current season's growth can be obtained. This period usually extends from July to September. When budding seedlings it may sometimes be necessary to delay the operation until the latter part of the season, in order that the stock may develop to a satisfactory size; but when top working older trees by this method well-developed buds may be handled whenever the trees are in a vigorous condition of growth. Figure 7 shows a branch of a young persimmon tree on which a shield or T-bud has made considerable growth.

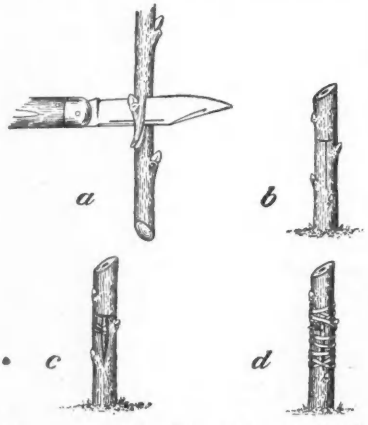

FIGURE 6.—The different steps in shield or T-budding: *a*, Cutting the bud; *b*, preparing the stock; *c*, inserting the bud; *d*, tying.

Some of the precautions which it has been found important to observe when propagating pecans are equally applicable in the propagation of persimmons. The following directions for budding pecans according to the various methods are therefore presented here.[4]

Annular Budding

The process [of annular budding] is also known as "ring" and "flute" budding. It is performed during the midsummer months at such time as the bark is found to slip (release) most readily. In some seasons this period may be very brief, lasting only a few days, while in other years the time during which annular budding may be successfully performed extends over a period of several months. In the latitude of southern Georgia it is not uncommon for this method to be successful from as early as May 10 until late in July or even in August.

Annular budding consists merely in transferring a ring of bark to which is attached a bud of the desired variety from a bud stick to the trunk or branch of another tree in place of a similar ring of bark previously removed. Specially designed tools * * * have been devised for the purpose of cutting the rings. Two ordinary propagating knives having single blades may be fastened together and made to answer the purpose, although they are less liable to make uniform incisions. Cut a ring of bark from the stock with one of the tools, slit it with a single-bladed knife, and lift from its bed or "matrix," as it is technically called. Discard this bark and from the bud stick remove a similar ring, in the center of which is a dormant bud. The bark of the bud stick should be slit on the side opposite the bud. Immediately place this ring in the space left by removing the bark from the stock and wrap at once with waxed cloth, taking care not to cover the bud * * * [fig. 8].

[4] From Bureau of Plant Industry Bulletin 251, The Pecan. Out of print, but may be consulted in libraries. See also Farmers' Bulletin 1501, Nut-Tree Propagation.

Patch Budding

When the annular method is used it is obvious that the stock and scion must be of nearly the same size. If the bud stick is slightly larger than the stock a portion of the bark to which the bud is attached may be cut away so that the two ends of the ring just meet around the stock. If the bud stick should be smaller than the stock a strip of bark on the latter may be left in position to complete the ring. In actual practice, rings which extend only partly around the stock are most commonly used. Such process, however, is not true annular budding, because any bark which extends only partly around the stock is merely a patch. It is to this deviation from the annular method of budding that the term "patch budding" has been applied. A tool specially designed for patch budding * * * consists of four thin steel blades fastened together in the form of a rectangle, five-eighths of an inch wide by 1 inch long, and is used as a punch. * * * A cut is made in the bark of the bud stick about half an inch in width by three times as long, in the center of which is the bud. The piece of bark so outlined is removed from the bud stick and laid over that of the stock. Using this as a pattern, incisions are then made around it in the bark of the stock. The pattern is then removed, the section of bark outlined in the stock is lifted, and the bark from the bud stick is put in its place. Some varieties of the pecan are more difficult to bud successfully than others; with such varieties the annular method, or a near approach to it, is generally most successful.

With the average sorts, however, the tendency among the more experienced nurserymen is much inclined to favor the patch method * * *.

The buds best suited to annular or patch budding are those in the axils of the leaves at the base of the current season's growth. It is well worth the time required to clip the leaves away, close to the buds, 10 days or 2 weeks before the bud is wanted, for by so doing the wound will heal over before the bud is needed; otherwise a serious lessening of the vigor of the bud through evaporation may take place.

FIGURE 7.—A shield or T-bud after considerable growth has been made.

In annular budding the added ring of bark sometimes unites with the stock promptly, permitting the upward flow of sap to proceed without much interference. When this is the case the top should be carefully pruned back to such a degree as is necessary to direct sufficient sap into the new bud to cause it to swell. This pruning should not be done with too great severity, as an oversupply of sap is liable to accumulate under the bark of the new bud and cause it to decay, or, as it is termed, "to drown" the bud. If the tree is young and the growth has been rapid, precaution should be exercised in cutting back the top, in order not to expose the tender bark to the heat of the sun. A sufficient amount of foliage should be left as a protection from the hot sun. If the supply of sap is limited, it will be well to cut out all buds in the top of the stock, as shown in * * * [fig. 8]. All dormant buds, both above and below the new bud, should be rubbed off as soon as they begin to swell. The wrapping about the new bud must be cut as soon as growth begins. As the union of a bud with a stock made by any method of budding is at first merely the uniting together of bark and not of wood, it is necessarily weak during the first few months. To avoid danger of breaking out at the bud, the new tops should be provided with extra support. For this purpose side stakes driven into the ground are sometimes used, but these are expensive, and unnecessary. By leaving a stub of the original top 8 or 10 inches long, entirely denuded of foliage * * * [fig. 8], the new top may be quickly tied to it, and when no longer needed the dead stub may be cut away close to the union.

Chip Budding

Propagation by chip budding is performed in the early spring or late in the dormant period. Because of being done at this season it is also known as "dormant" budding. With a sharp knife a downward cut is made below the bud on the bud stick to a depth of perhaps one-eighth of an inch. Raising the knife to a point above the bud a long downward cut is made, which meets the lower end of the first cut, and the bud is removed with a chip attached, as shown in * * * [fig. 9]. A similar chip is removed from the stock, and the desired bud is put in its place. This should be carefully wrapped with such material as will hold the cambium layers of the stock and the bud firmly together on at least one side.

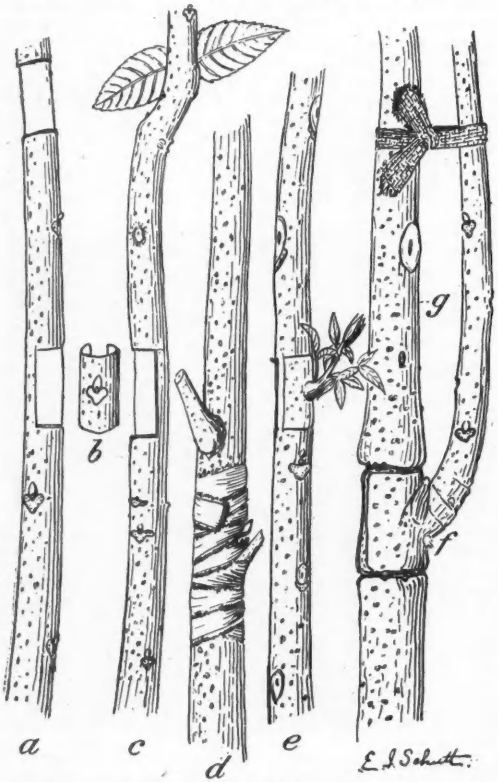

FIGURE 8.—Annular budding: *a*, Bud stick from which the bud has been removed; *b*, the bud ready for insertion in the matrix of the stock; *c*, the stock ready to receive the bud; *d*, the bud after being placed in position and carefully wrapped; *e*, growth taking place, the wrapping having been removed; *f*, growth from the bud supported by being tied to the stock (*g*) above the union. Note the scars above the union, where the buds were removed in order to direct the flow of sap to the new bud.

Subsequent treatment similar to that already described for annular and patch budding should be given young trees propagated in this manner.

Trees of the pecan species are difficult to propagate asexually, that is, neither buds nor scions "take" with the readiness of ordinary fruit trees. The inexperienced operator, therefore, must expect a low percentage of living buds as the result of his first attempts. Skilled propagators, however, are now so successful that under favorable conditions the percentage of failures is no longer a matter of consequence.

No attempt to bud pecans should be made on rainy days, or in early mornings following heavy dews. Some nurserymen even go so far as to select their men for budding the pecan, assigning those who perspire most freely to other duties. Extremely hot days should be avoided, especially if accompanied by drying winds. Moderately cool, cloudy days without wind or rain are the best for pecan budding.

Figure 10 shows a persimmon chip bud which had made considerable growth.

Protection of Buds

A very satisfactory means of affording protection to buds inserted by any of the foregoing methods is shown in figure 11. These waxed

shields are intended as a substitute for the waxed strips previously mentioned, and their preparation and use has been described as follows: [5]

In making the waxed wrappers, old domestic worn bed sheets or undergarments may be used. Tear it into strips 2 feet long and 6 inches wide; then fold it into squares and dip it into a tin plate of hot, melted beeswax. The wax will strike through instantly, and then the strips may be held up by one end and the surplus wax allowed to drip back into the tin plate. When cool, the cloth may be torn into * * * squares of proper size. No pressing or squeezing is necessary. * * * The beeswax answers the purpose * * * in every way; it saves the buds, and that is the end in view. These wrappers may be left on the buds the whole season. When the bud shoots are an inch or so in length, the strings may be unwound from so much of the wrappers as cover the buds, but tie the upper end of the wrapper, which is above the bud, firmly to the projecting stub. The eyelets [6] in the wrappers will open as the bud shoots grow, and protection will be afforded against hot suns and chilly nights.

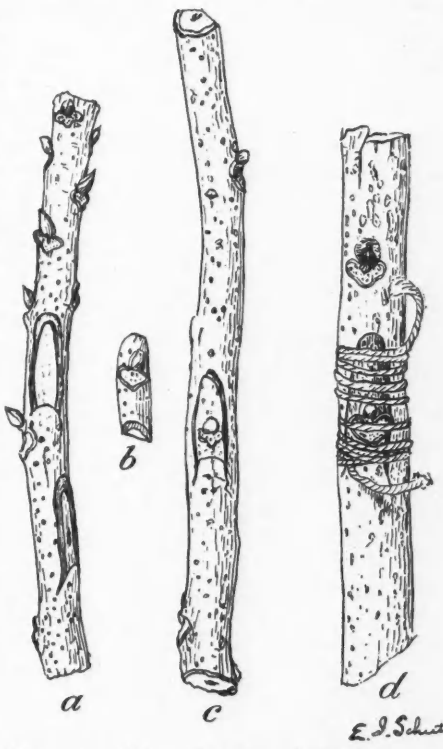

FIGURE 9.—Chip or "dormant" budding: *a*, The bud stick; *b*, the bud ready for insertion; *c*, the bud inserted in the matrix of the stock; *d*, the bud securely tied in place.

Cleft Grafting [7]

This style of graft is particularly adapted to large trees when for any reason it becomes necessary to change the variety. Branches too large to be worked by other methods can be cleft-grafted.

A branch 1 or 1½ inches in diameter is severed with a saw. Care should be taken that the bark be not loosened from any portion of the stub. Split the exposed end with a broad, thin chisel or grafting tool * * * [fig. 12, *a*]. Then with a wedge or the wedge-shaped prong at the end of the grafting tool spread the cleft so that the scion * * * [fig. 12, *b*] may be inserted * * * [fig. 12, *c*].

The scion should consist of a portion of the previous season's growth and should be long enough to have two or three buds. The lower end of the scion, which is to be inserted into the cleft, should be cut into the shape of a wedge, having the outer edge thicker than the other * * *. In general, it is a good plan to cut the scion so that the lowest bud will come just at the top of this wedge, * * * so that it will be near the top of the stock. * * * The importance of having an intimate connection between the growing tissues of both scion and stock cannot be too strongly emphasized, for upon this alone the success of grafting depends. To make this contact of the growing portions doubly certain, the scion is often set at a slight angle with the stock into which it is inserted, in order to cause the growing portions of the two to cross.

[5] From American Fruit and Nut Journal, v. 6, whole No. 94, p. 22.
[6] The eyelet referred to is the small hole in the center of the protector shown in fig. 11.
[7] See footnote 3.

After the scions have been set the operation of cleft grafting is completed by covering all cut surfaces with a layer of grafting wax.

Cleft grafting has given satisfactory results with the persimmon, both on the branches (fig. 13) and at the crown (fig. 14).

Whip Grafting [8]

[Whip grafting is the method] * * * almost universally used in root grafting. It has the advantage of being adapted to small plants * * *.

The graft is made by cutting the stock off diagonally—one long smooth cut with a sharp knife * * * as shown in [fig. 15, *a*]. Place the knife about one-third of the distance from the end of the cut surface, at right angles to the cut, and split the stock in the direction of its long axis. Cut the lower end of the scion in like manner * * * [fig. 15, *b*], and when the two parts are forced together, as shown in * * * [fig. 15, *c*], the cut surfaces will fit neatly together, and one will nearly cover the other if scion and stock are of the same size. A difference in diameter of the two parts to be united may be disregarded unless it be too great. After the scion and stock have been locked together, as shown in * * * [fig. 15, *c*], they should be wrapped with five or six turns of waxed cotton to hold the parts firmly together.

FIGURE 10.—A chip bud on a branch after the bud inserted had made considerable growth.

While top grafting may be done in this way [fig. 16], it is in root grafting that the whip graft finds its distinctive field. When the roots are cut into lengths of 2 to 5 or 6 inches to be used as stocks, the operation is known as piece-root grafting. Sometimes the entire root is used.

* * * * *

In ordinary propagation by means of whip grafts, the scion is cut with about three buds, and the stock is nearly as long as the scion. The graft is so planted as to bring the union of stock and scion not very far below the surface of the ground * * *.

Care of Whip-Grafted Stock [9]

When grafted by the whip-graft method the young trees will require little subsequent attention other than pruning and ordinary cultivation. When the root is that of a very young tree there will be no danger of the supply of plant food being such as to induce a growth of top that is too rapid, as is frequently the case with cleft grafts, especially in the tops of old trees. While temporary staking as a support to the union is not necessary, in numerous cases stakes will be highly essential to insure erect growth. The moisture of the ground causes the wrapping material to decay in the course of a few weeks, and it is therefore not necessary to cut the bands * * *.

The operation of grafting most fruit trees is generally successful if performed in the spring when the trees are still dormant, or even after growth has started slightly, provided the scions are entirely dormant. In the case of the persimmon, however, much more satisfactory results appear to be obtained when the grafting is delayed until the trees have definitely started into new growth. The scions must be kept dormant.

[8] See footnote 3.

[9] See footnote 4.

In all of the various methods of budding and grafting the persimmon it is of the utmost importance that the cut surfaces of both bark and wood be protected with as little delay as possible from chemical change due to exposure to the air. Protection is afforded by covering the wounds with grafting wax, waxed cloth, or similar devices.

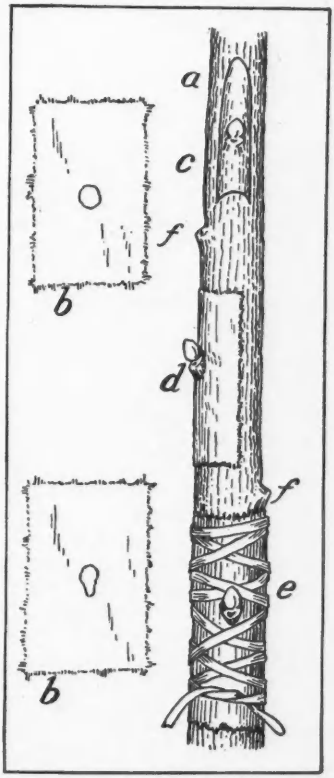

FIGURE 11.—Method of using a bud protector on a chip bud. The protector may be used in a similar manner in all of the different forms of budding. *a*, Stock; *b*, *b*, waxed cloth protectors; *c*, chip bud fitted into notch in stock; *d*, protector in position over the bud; *e*, protector and bud wrapped and tied; *f*, *f*, scars of buds removed from stock. (Adapted from drawing in American Fruit and Nut Journal, vol. 6, whole No. 94, p. 23.)

STOCKS AND NURSERY TREES

The stocks in the nursery row should stand at least 6 inches apart to afford space for root development and to give the workmen plenty of room when the trees are budded or grafted. The young trees in the nursery should receive fair cultivation, and the roots should be pruned each year with a tree digger or spade, in order to keep the root system small enough to be handled with ease when the trees are dug. The 2-year-old roots are always preferable for stocks. Older roots small enough to be easily handled are likely to be stunted, and 1-year-old roots must be very thrifty to produce the desired growth in the graft.

Trees produced under conditions favorable for development may be planted in their permanent location after they have made one season's growth in the nursery. Some varieties, however, are much more vigorous than others. It may be advisable to grow the weaker sorts in the nursery for 2 years before transplanting them. Figure 17 shows two varieties of grafted persimmon trees that have made one season's growth in the nursery.

On account of the very long taproot that persimmon trees habitually develop, particularly when propagated on seedling stocks, much care must be exercised to avoid undue injury to the root systems when the trees are dug from the nursery. Moreover, because of the deep-rooting habits of these trees a deep soil should be selected for their permanent location.

PLANTING AND CARE OF TREES

The transplanting of the young trees may be done at any time during the dormant period, from late autumn to early spring, when

the roots can be protected from freezing temperatures and evaporation and when the soil is in a suitable condition for handling. If the trees have been properly taken up without undue injury to the roots, the tops will need little or no pruning. If, on the other hand, the root systems have been severely reduced, the tops should be headed back until the total length of branches and trunks corresponds in a general way to the total length of the main roots. Wounds on both tops and roots should be waxed as soon as made.

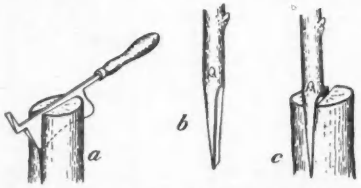

FIGURE 12.—Cleft graft: *a*, Stock being split by special grafting tool; *b*, scion ready for insertion; *c*, scion in place ready for waxing.

Young persimmon trees have large deep root systems and should be planted 2 or 3 inches deeper in the orchard than they were in the nursery row. In setting them out the soil should be packed thoroughly around the roots. A round-pointed wooden tamp is a very serviceable tool with which to make the earth compact as the hole is filled up. The planting plan varies with the type of tree desired. If it seems desirable to grow low-headed trees with the expectation of producing large fruit that can be readily picked by hand, the permanent trees should be placed at least 16 or, better still, 20 feet apart each way. If, however, a large bulk of fruit is desired as stock feed to be scraped from the ground or picked up by animals, a fair degree of success may be expected if the trees are planted 10 feet apart each way.

Probably the persimmon can be more successfully intercropped than any other fruit tree, owing to the depth of its root system. Blackberries, dewberries, strawberries, and vegetables thrive very well among persimmons until the shade becomes too dense. When the trees shade the ground, it is best to seed down the orchard if it is to be used as a run for chickens, calves, pigs, or other animals, and the fruit used as stock feed. If it is planned to produce fruit for market purposes, however, the same cultivation should be given the ground as in a commercial orchard of peach or other fruit trees.

FIGURE 13.—A cleft graft made on a small branch.

PRUNING

The pruning of the persimmon varies with the variety. There is a tendency for the tree to prune itself, as many of the fruit-bearing

twigs die and drop off with their fruit, thus making the natural open growth of the trees still more open and reducing to a minimum the necessity for pruning. There are two points, however, which should be borne in mind: (1) The upright tendency of some of the most vigorous varieties should be checked by pinching off the tender growing tips as they get out of reach, and (2) those trees that do not prune themselves sufficiently to keep the top well open should be thinned by removing entire limbs, either main or secondary. This practice is preferable to opening the tops by thinning out the small branches and thus leaving the larger limbs bare for a considerable portion of their length. Thinning admits light and air, and at the same time a stronger vegetative growth is induced; the result is that the size of the fruit is kept uniform and the crops are made more regular by reducing the tendency to overbear on alternate years.

All wounds should be painted or otherwise covered as soon as made, in order to prevent the wood from drying or dying back and decay from entering the body of the trees. It has not been determined how effective wound treatments may be in reducing the amount of persimmon wilt.

FIGURE 14.—A cleft graft made at the crown, the soil that normally covered the union having been removed in order to show the parts to better advantage.

DISEASES AND INSECTS

WILT

Until a few years ago the native persimmon tree and its fruit were singularly free from fungus or other diseases, but in 1937 there was reported by the Division of Forest Pathology, of the Bureau of Plant Industry, a

new disease that threatens the existence of the persimmon, at least in the Southern States. A brief account, prepared by that Division, follows.

A wilt disease caused by a fungus belonging to the genus *Cephalosporium* was first found in Tennessee and later in Mississippi, Alabama, Georgia, Florida, South Carolina, and North Carolina. In 1939 several outbreaks of this disease were discovered in Texas. Observations indicate that the disease is spreading. In some areas observed it has killed more than 90 percent of the trees.

The disease is characterized internally by fine brownish-black streaks in the wood, and externally by a sudden wilting of the leaves, followed by defoliation, first of the upper branches and eventually of the entire tree. Occasionally a tree carrying an infection from the preceding year will leaf out in the spring with small, chlorotic leaves. These gradually droop and fall during the early summer. Infected trees usually die by late summer, and large quantities of salmon-pink spores of the causal fungus are produced between bark and wood.

The Asiatic persimmons (*Diospyros lotus* L. and *D. kaki* L.) are apparently highly resistant to, although not immune from, the disease. Where rootstocks of the native persimmon are used for grafting or budding with varieties of *D. kaki*, wilting of the entire tree occurs if the native rootstock becomes infected by the wilt fungus. No opportunity has been found to test selected horticultural varieties of the American persimmon other than Kawakami. This variety was found to be fully as susceptible to the wilt fungus as any other native tree. Thus far no wilt-resistant native tree has been found.

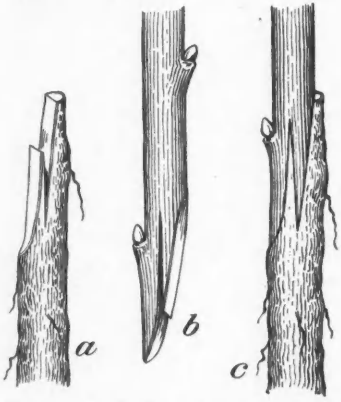

FIGURE 15.—Whip graft: *a*, Stock prepared; *b*, scion prepared; *c*, stock and scion fitted together ready for tying.

If growers have orchards or individual trees prized for their fruit or ornamental value, it is suggested that a careful watch be kept of native trees in the vicinity. If the disease appears in them or in the orchard itself, the wilting tree should at once be removed and the wood burned. Under moist conditions wood from an infected tree will sometimes have spores produced on it. Spores of the fungus are air-borne, at least to a considerable extent, and apparently enter the tree through wounds. Care in handling the trees so as to prevent wounds and eradication of the hickory twig girdler, which creates ideal entry places for the fungus, are suggested as basic control measures.

HICKORY TWIG GIRDLER

The persimmon is exceptionally free from the attacks of insect pests. Probably the most important of the insect enemies of the persimmon is the hickory twig girdler. The following brief account of the life history and habits of this insect, prepared for this bulletin by the Bureau of Entomology and Plant Quarantine, may be of interest to those who anticipate growing the persimmon.

The hickory twig girdler, *Oncideres cingulata* Say, makes its appearance about the middle of August and may be found until the first of October. It begins depositing its eggs about the latter part of August and continues the process well into October. The eggs hatch in from 7 to 9 days after deposition, and the young larva begins to feed on the inner bark and wood at the point where the egg was inserted beneath the bark. As the larva increases in size it continues to feed on the wood, going deeper into the twig, and by the time its full growth has been attained it often completely hollows out the twig for some little distance from the point where it began work. Some of the larvae attain their full growth and begin transformation to pupae about the first of August. Others do not make this change until near the middle of September. The pupal stage lasts from 10 to 14 days, when the insects transform to adults and emerge from the twigs where they have spent their lives. Several days pass before they begin laying their eggs in the small limbs and twigs.

The injury caused by this insect occurs in the process of oviposition. The adult gnaws a small hole in the bark, usually just above or just below a bud, and the egg is inserted beneath the bark by means of the ovipositor. Several eggs are usually deposited in a twig in this manner, and the insect then begins girdling the twig beneath the point of oviposition by gnawing out small pieces of the bark. A ring is thus made around the twig, perhaps a third of the way through, weakening it to such an extent that it is broken off by the wind during the winter or the following spring. The trees are often severely injured by having the young growth pruned off in this manner.

In order to control this insect the twigs should be picked up from the ground in June or early July. All twigs which are found at this time have been girdled and broken from the tree and should be collected and burned in order to destroy the insects which are inside them.

FIGURE 16.—A whip graft after attaining considerable growth.

USES OF PERSIMMON WOOD

The latest representative figures available on the use of persimmon wood are those for 1928, when a little more than 2,000,000 board feet, equivalent to about 4,000 cords and nearly all in the form of logs and bolts, was reported by the manufacturers of wooden products. About three-fourths of this was used for golf-club heads, and nearly all the remainder was made into shuttles used in the textile industry. Small amounts were reported for shoe lasts and small handles. For golf-club heads, persimmon is the outstanding wood. Its hardness, uniform texture, and ability to stay in place enable it to meet the requirements of this exacting use. For shuttles, its value lies principally in its ability to stay smooth under continued wear.

POSSIBILITIES OF PERSIMMON TREES IN EROSION CONTROL

In recent studies made by this Department of plants suitable for use in controlling soil erosion, the native persimmon tree has been given considerable attention.

Within its region of natural growth, it is one of the first woody plants to take hold in old fields and other areas of soil that have been abandoned because of erosion damage. This reclamation of eroded lands by the persimmon is a common occurrence in the territory south of the Potomac and Ohio Rivers and in the northern part of the Ozarks, where much of the land is on steep slopes and soil erodes readily and rapidly unless it is protected by vegetative cover. After a few years the persimmon sprouts bring about the development of leaf litter on the soil surface, and this is quite effective in slowing down soil losses. On many eroded sites, observation shows that erosion has been completely controlled by these volunteer trees.

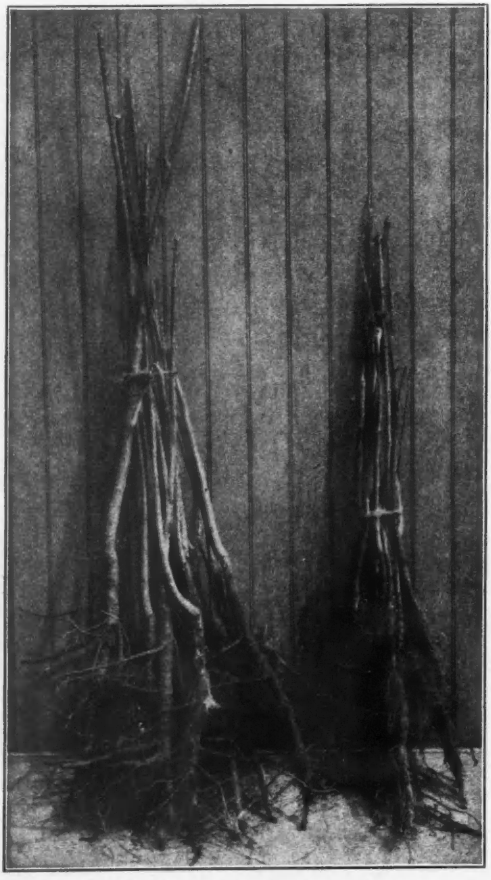

FIGURE 17.—Persimmon trees after making one season's growth in the nursery. These trees were propagated by grafting on seedling stocks. The bundle on the left is the Golden Gem variety; on the right, the Miller. The largest trees are 4 to 5 feet tall. The difference in the size of the trees in the two bundles is due to the difference in the natural vigor of growth of these two varieties.

The high carbohydrate content of the persimmon fruits and the readiness with which they are eaten by livestock make persimmon trees especially valuable for planting as an effective means of conserving soil and moisture on farm land retired from cultivation and converted into pasture. The forage value of such pasture plantings is enhanced if some of the improved, heavy-bearing persimmon selections are used. There is no question that the native persimmon tree is of high value as an economic

erosion-control plant. However, as the spread of the new wilt disease of persimmon may cause the loss of native and planted stands of this native species, soil conservationists are cautious about encouraging the planting of the persimmon at this time.

HANDLING THE FRUIT

The persimmon fruits intended for shipment should, to avoid bruising, be carefully hand-picked while still quite firm, that is, just as the flesh begins to soften. Fruits that can be delivered direct to the consumer should not be picked until fully mature and should also be handled with great care. Fruit of the later varieties, especially those of the oblong type, often hang on the trees for weeks, drying to about the consistency of the commercial date.

Quart and pint berry boxes are commonly used when packing the fruit for market, the boxes being handled in the ordinary strawberry crate. Larger units would result in bruising the softer fruits and therefore are not advisable.

USES OF THE FRUIT PULP IN COOKERY

The suggestions given in this section for serving native persimmons are based on tests [10] made with fruit of the Miller, Josephine, Ruby, Hicks, and Kawakami varieties grown at the Arlington Experiment Farm, Arlington, Va., near Washington, D. C. Fruit so ripe that it had dropped from the trees, and also less mature fruit picked from the trees, was used. The different varieties were judged for quality and utilized in various ways. The Miller and Ruby were thought to have the best flavor, with less astringency and more body than the others. The Josephine and Hicks were less uniform in astringency. Some of the ripe fruits of each variety were very astringent; others were free from astringency. The Kawakami was considered less desirable than either the Miller or the Ruby, as it was less sweet and had less flavor, and the flavor was not entirely pleasant. There seemed to be little difference in the quality of the tree-ripened fruit that had dropped to the ground and the less mature fruit picked from the trees and ripened at room temperature before it was used.

As compared with other fruits, the native persimmon ranks high in sugar content, as is shown by chemical analyses reported in Department of Agriculture Circular 50, Proximate Composition of Fresh Fruits,[11] and in Department of Agriculture Circular 549, Proximate Composition of American Food Materials.[12]

Before the advent of the white man, the Indians mixed the pulp of the persimmon with crushed corn and made it into a kind of bread, and, following the modern ideas of cookery, the Food Utilization Section of the Bureau of Home Economics finds that persimmons can be used in a variety of ways.

The astringency of persimmon pulp may be counteracted to some extent if soda is added to the pulp before it is heated. The quantity of soda to use varies with the degree of ripeness and the variety of the fruit, but one-fourth teaspoon of soda to 1 cup of the persimmon pulp is an average. Persimmons will discolor if cooked in tin utensils. Products made without additional acid will turn dark if they stand too long before cooking or serving.

[10] These tests were made by the Bureau of Home Economics, and the recipes, based on these tests, were prepared in that Bureau.

[11] Out of print. May be consulted in libraries.

[12] For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents a copy.

RECIPES USING PERSIMMON PULP

Baked Persimmon Pudding

2 cups pulp
3 eggs
1¾ cups milk
2 cups sifted flour
½ teaspoon soda
1 teaspoon salt
½ teaspoon cinnamon
½ teaspoon nutmeg
1½ cups sugar
3 tablespoons melted butter

Mix the persimmon pulp, beaten eggs, and milk. Sift the dry ingredients together and pour the liquid mixture into them. Stir in the melted butter and pour into a shallow greased pan to the depth of about 2 inches. Bake for about 1 hour in a very moderate oven (300° to 325° F.). When cold, cut into squares and serve with plain or whipped cream.

Steamed Persimmon Pudding

¼ cup butter
½ cup sugar
2 eggs
1½ cups pulp
⅜ teaspoon soda
½ cup sifted flour
2 teaspoons baking powder
¼ teaspoon salt

Cream the butter, add the sugar, beaten eggs, and persimmon pulp. Sift the remaining dry ingredients and combine with the first mixture. Pour into a greased mold, cover, and steam for 1½ hours.

Persimmon Custard

2 cups pulp
½ cup sugar
½ teaspoon soda
2 egg yolks, beaten slightly
¼ teaspoon cinnamon
⅛ teaspoon nutmeg
1/16 teaspoon salt

Combine the ingredients, pour into a baking dish surrounded by hot water, and bake in a slow oven (250°–300° F.) for about 15 minutes.

Make a meringue, using two egg whites, one-fourth cup of sugar, and one-sixteenth teaspoon of salt. Place on top of the custard and bake in a slow oven (250°–300° F.) until lightly browned.

Persimmon Whip

1 cup pulp
½ cup sugar
5 egg whites
¼ teaspoon salt
3 tablespoons lemon juice

Heat the persimmon pulp with the sugar. Fold the hot mixture into the stiffly beaten egg whites to which the salt has been added. Mix in the lemon juice, place in a baking dish surrounded by hot water, and bake in a very slow oven (225°–250° F.) for about 1 hour.

Persimmon Cornstarch Pudding

½ cup sugar
⅓ cup cornstarch
⅛ teaspoon salt
½ cup cold water
1½ cups boiling water
¼ teaspoon soda
1 cup pulp
¼ teaspoon cinnamon
1 tablespoon lemon juice

Mix the sugar, cornstarch, salt, and cold water thoroughly in a double boiler. Add the boiling water and stir until the mixture thickens. Add the soda to the persimmon pulp and combine with the cornstarch mixture. Cover and cook for 15 minutes. Add the cinnamon and lemon juice, pour into a mold, and chill. Serve plain or with cream.

Persimmon Cake

½ cup fat
1 cup sugar
1 cup pulp
2 eggs
¼ teaspoon soda
2 cups sifted flour
3 teaspoons baking powder
½ teaspoon salt

Cream the fat and sugar together, add the persimmon pulp and beaten eggs. Sift the dry ingredients and add to the liquid mixture. Beat well, pour into a greased pan, and bake in a moderate oven (325°–375° F.) for about 1 hour.

Persimmon Sherbet

1 cup water
1 cup sugar
2 cups pulp
Juice ½ lemon
⅛ teaspoon salt
1 egg white

Boil the water and sugar for 1 minute, and put aside. When cold, add the persimmon pulp, lemon juice, salt, and unbeaten egg white, and freeze with a mixture of 1 part salt to 4 to 6 parts of ice. Turn the crank slowly until the mixture is firm. Remove the dasher, pack the freezer with more ice and salt, and let the sherbet stand for an hour or more to ripen.

Preserved Persimmon Pulp

Mix equal amounts by measure of persimmon pulp and sugar and place in glass jars. Partially seal and process pint jars for 15 minutes in a boiling water bath. Seal and store in a cool place.

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